NAVAL WARFARE ANALYSIS EXPERIMENT

A thesis submitted to the faculty of
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Master of Arts
in
Social Science
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by

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San Francisco, California

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CERTIFICATION OF APPROVAL

I certify that I have read NAVAL WARFARE ANALYSIS EXPERIMENT by Thomas H. Barr, and that in my opinion this work meets the criteria for approving a thesis submitted in partial fulfillment of requirements for the Master of Arts in Social Science (Interdisciplinary Studies) degree at San Francisco State University.

NAVAL WARFARE ANALYSIS EXPERIMENT

Thomas H. Barr
San Francisco State University
1981

The Naval Warfare Analysis Experiment (NAVWARANALEX) is an intelligence research project that commenced in January 1980. Its purpose is the design and installation of an experimental information system on the Naval Intelligence Command On-Line System (NICOLS) to demonstrate potential improvements for the Ocean Surveillance Information System (OSIS). The research design is based upon a systems model for problem solving which entails assessment of the reality situation and the development of conceptual models in order to specify the criteria for the construction of scientific models that will yield proposed solutions to the problem. The methods employed in the project include those applicable to threat assessment, activities analysis, systems analysis and management information systems. Results obtained in the project to date indicate that the experimental information system offers OSIS improved automatic data processing capabilities to support both quantitative and qualitative activities analysis, and management of naval warfare information.

NAVAL WARFARE ANALYSIS DEPARTMENT

Thomas [illegible]
San Francisco State University
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The Naval Warfare Analysis Department [illegible] is an intelligence research project that commenced in early 1967. Its purpose is the design and [illegible] an experimental information system [illegible] group-oriented On-Line System [illegible] that requirements for the [illegible] System design. The research [illegible] tree model for [illegible] of the [illegible] structure and the [illegible] models in order to [illegible] tion of scientific models [illegible] tions to the problem. The [illegible] include those applicable [illegible] analysis, content analysis and [illegible] tems. Results obtained in the [illegible] that the experimental information [illegible] present automatic data processing capabilities [illegible] both quantitative and qualitative [illegible] analysis and management of naval warfare information.

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DEDICATION

The development of the Naval Warfare Analysis Experiment is dedicated to CDR Hal Sacks, USN (Retired), and CAPT Stan Strickland, USNR, who initiated me into the command and control world and indicated the potential of ADP applications to intelligence as we participated together in the Antisubmarine Warfare Command and Control System (ASWCCS) in the early 1970s. It is also dedicated to CDR Stan Zapatka, USN, and CDR Dave Peszko, USN, whose ideas and support proved instrumental to the development of the forerunner to the Naval Warfare Analysis Experimental Information System, the Naval Tactical Warfare File, in the Joint Intelligence Center on board USS MOUNT WHITNEY (LCC 20) in the mid 1970s. Finally, it is dedicated to Professor Patrick J. Parker and Professor William Reese, with whom many long discussions were conducted concerning the application of quantitative analytical techniques to intelligence problems during intelligence curriculum development sessions at the Naval Postgraduate School in the late 1970s, and who encouraged me to pursue this master's program in information science, data systems and quantitative management.

ACKNOWLEDGEMENT

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THESIS OUTLINE

The outline that follows this section indicates all the headers that are contained in the thesis. It includes the page numbers that are applicable to each thesis section and the subsections contained in that section. It is provided to assist the reader to follow the development of the thesis. Further, it assists the reader who desires to browse and focus only on the content that is relevant to his or her particular interests. Finally, the outline assists the reader to refer back (or forward) to other sections that may be related to the material currently being examined. The development of the thesis proceeds as indicated below.

Essentially, two primary processes are required to determine how to meet the threat in a conflict situation. These are threat detection/perception and crisis decision making. The purpose of Chapter I is to introduce the problems associated with these processes at the macro level of the system of international politico-military activities and the national politico-military systems that monitor, respond to and participate in these activities. The chapter presents the concepts, models and methodologies that will be applied in the remainder of the thesis. They have been extracted from the following areas of research: threat perception, crisis management, systems analysis and management

information systems.

Chapter II steps down in focus from the system of international politico-military activities monitored and perceived by management components of national politico-military systems discussed in Chapter I to the smaller system of international naval interactions. These interactions are monitored and perceived by management components within the U.S. naval system. The chapter places primary emphasis on the intelligence component within that management system and how it functions to serve the components of the larger naval system. It also details the participation of the intelligence officer in the intelligence system. Its purpose is to develop a systems analysis of how naval intelligence and the intelligence officer function in support of naval system objectives. This analysis seeks to provide the foundation for an understanding of how the design of the information system developed through the Naval Warfare Analysis Experiment offers automatic data processing support capabilities that can be applied to improve the role performance of both the intelligence system and the intelligence officer. The chapter concludes with a systems model for problem solving that provides the structure and approach for the remainder of the thesis. The components of this model include: the reality situation, the conceptual model, the scientific model, and the solution.

Chapter III then provides a threat assessment of the

particular reality situation addressed by the Naval Warfare Analysis Experiment. It describes the development of the Soviet Navy since the mid 1950s and indicates the expansion in naval activities conducted in direct support of Soviet security and foreign policy that has occurred within this period. It describes how these activities have escalated and delineates the potential threat they pose to the security interests of the Unites States and the Free World. Its purpose is to provide an understanding of Soviet naval activities as a foundation for later illustration of how the capabilities developed through the Naval Warfare Analysis Experiment enhance the processing, analysis and production of intelligence concerning these activities.

Chapter IV develops the conceptual model of an experimental information system for improved intelligence performance. This model specifies that the operational intelligence process should focus on nine key questions suggested by the requirements of the operational components of the naval system for the intelligence product. It then goes on to specify that the institutionalized requirements for reporting on foreign naval operations provide the analytical framework necessary to addressing the key operational intelligence questions. These reporting requirements are based upon consideration of the aspects of naval warfare. The chapter then establishes quantitative variables that may be measured as the result of the observation of naval activity and relates them both to the aspects of

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FIGURES

I. THREAT DETECTION/PERCEPTION AND CRISIS DECISION MAKING

The Threat of War

The threat and actual conduct of war consuming the major nations of the world has been a dominant problem of the twentieth century. The rapidity with which this threat can manifest itself and the awesome destructive power that can be unleased are what differentiate the twentieth century problem from that of previous eras. Modern technology continues to provide an ever widening range of means for one nation to inflict violent physical force upon another.

The actual conduct of war, however, is but one end of a specturm of activity or interaction conducted by nations as they proceed along the scale of conflict with one another. The theory of deterrence rests upon the capacity, preparedness and will of the defending nation to resolve the threat of conflict with an aggressor nation in the defender's favor, or at the very least, to minimize the direct impact of the conflict upon the life and security of the defender's people. Further, this theory must assume not only that the defending nation has the capacity and political will to inflict unacceptable damage upon an aggressor nation should the aggressor initiate war,

but also that the defender can detect escalating activity on the part of the aggressor, preceive the threat that it implies, and respond in sufficient time by mobilizing the resources required to meet the potential threat.

Relevant Research

The system that decides how to respond to a threat by mobilizing and directing the nation's resources to meet that threat is the national politico-military management system and the process is known as crisis management. The system that detects and perceives the threat is the intelligence component of that management system. The Naval Warfare Analysis Experiment is a project that seeks development of an experimental information system in order to demonstrate improvements that can be made to components of the U.S. intelligence system that will enhance their capabilitiy to detect and perceive potential naval threats to the nation's security and interests.

The purpose of Chapter I is to review the areas of research that have been examined in the project to date in order to present the concepts and methodology found in this relevant research which will be applied both to analysis of the intelligence system's functions and performance and to the design and development of the experimental information system that will suggest how that performance can be improved. These areas of relevant research include those applicable to threat detection and perception, crisis

management, systems analysis and management information systems.

The chapter first examines Russell Ackoff's development of a perception model. It discusses the concepts of stimulus-reaction-response, sensitivity and sensibility, and consciousness and memory that form the basic elements of this model. Then, the chapter builds upon these concepts by discussing the applicability of the model to the politico-military problems associated with the threat detection and perception process. These problems include Roberta Wohlstetter's concept of noise; time sensitivity and perishable data; cover and deception; and various factors that can complicate the defender's intelligence efforts. These factors include the dictates of security requirements, bureaucratic blocks to communication, organizational status and prestige, and predominant beliefs concerning enemy behavior.

From threat perception, the chapter proceeds to examination of the crisis management process. It reviews Graham Allison's three models that illuminate the sociological/organizational aspects of crisis decision making. Then it provides examples of these models and concepts from other research as they apply to the politico-military aspects of crisis management. The problem areas addressed in this discussion include those related to political pressures, organizational inertia, influence of the participants, alliance commitments, military capabilities, strategy and

doctrine, and crisis management imperatives.

Upon completion of the presentation covering the concepts, models and problems relevant to the threat detection/perception and crisis management process, the chapter turns to discussion of the concepts and models associated with the primary methodology that has been applied in the Naval Warfare Analysis Experiment, systems analysis. This section first defines the system as a holistic concept. Next, it outlines C. West Churchman's criteria that should be adhered to when conducting systems analysis. Continuing with Churchman, it emphasizes the three broad areas of responsibility with regard to management's role in the performance of a system. These include setting goals, allocating resources, and controlling system performance. Then, it describes the four functions management components perform in order to meet these responsibilities: Identifying problems; making decisions; controlling the decisions made; and providing the information required to perform the first three. Finally, it discusses concepts and models related to the development of information systems that can perform effectively the last management component function. The discussion of design criteria highlights what Ackoff calls erroneous assumption that designers make about information systems which result in ineffective performance. The section concludes with a presentation of an information system

that has been developed by Professor Ronald G. Sherwin at the Naval Postgraduate School to support the threat detection/perception and crisis management processes.

The Threat Detection/Perception Process As a Psychological Problem

The perception process

Russell L. Ackoff developed a model of an individual psychological system that offers several concepts that are useful to explanation of the perception process. This process involves a stimulus produced in the environment, a reaction comprised of a change in the structural properties of the respondent to that stimulus, which in turn leads to the respondent choosing a course of action as his response. This model, shown in Fig. 1, is in the form of a basic systems diagram with the stimulus as the input, the reaction representing the transfer function performed as a result of the stimulus, and the response as the output resulting from that transfer function.[1]

Ackoff sees an individual's or a system's perceptiveness as being based upon the concepts of sensitivity and sensibility. The degree of sensitivity is the probability that the respondent will react to the stimulus in the given

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[1]The perception model and the concepts that follow are discussed in greater detail in Russell L. Ackoff and Fred E. Emery, On Purposeful Systems, (Chicago and New York: Aldine-Atherton, 1972), Fig. 4.1, pp. 65 - 78.

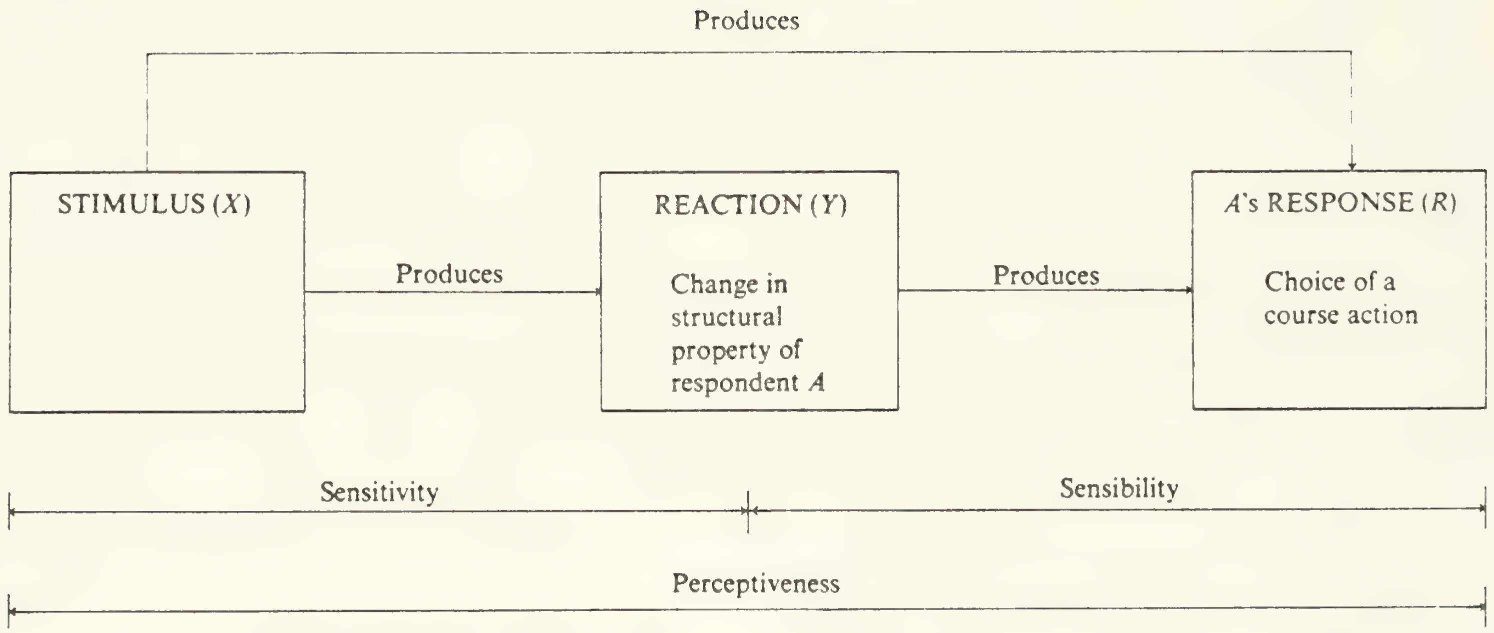

Fig. 1. Model of Perception

environment. Sensibility depends upon the respondent being in a purposeful state and its degree is defined as the probability that the respondent will respond to the transformation in his structural properties produced as his reaction to the given stimulus as a result of his being in that purposeful state. Ackoff then relates both these concepts to mathematical functions. The sensitivity function he defines as that function that relates the respondents degree of sensitivity to the stimulus produced by the environment and to the structural properties of that environment. The sensibility function he defines as that function that relates the respondent's degree of sensibility to the intensity of his reaction and to the properties of his purposeful state.

<u>The concepts of consciousness and memory</u>

Ackoff offers two other concepts as his final refinements to this process. Consciousness is the awareness of another's and one's own mental state, which he defines as any one or a combination of the functional properties of an individual's purposeful behavior. Memory is the factor that permits an individual to respond at one moment in time to something he sensed earlier. Consciousness then becomes dependent not only on perceiving the behavior that produces the stimulus, but also upon perceiving the mental state that contributed to the behavior. The memory function becomes a

a coproducer of one's present observations and conclusions by allowing both retrieval of past experiences related to the present stimulus and a more purposeful response as a result of this retrieval.

As Policito-Military Problems

The problem of noise

Building upon Ackoff's model of perception, the concepts associated with that process may be applied to particular problems that exist in, but are not necessarily unique to, the politico-military environment. Roberta Wohlstetter, in her book Pearl Harbor: Warning and Decision, draws particular attention to the significant amount of "noise" that exists in the politico-military environment. This problem involves the sorting out of the meaningful signal from the abundance of irrelevant information existing in the environment.[2] The meaningful signal relevant to a particular threat, which seems so perfectly clear given hindsight after the manifestation of the threat it indicates, comes to the observer imbedded in current noise. This noise includes an abundance of both meaningless signals and meaningful signals that are relevant to a

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[2]The concept of noise and other problems observed as cited in the passages that follow are taken from the section in "Retrospect and Perspective" in Roberta Wohlstetter, Pearl Harbor: Warning and Decision, (Stanford, California: Stanford University Press, 1962), pp. 382-396.

variety of other activities that are being conducted simultaneously. The sheer volume of activity may be sufficient to obliterate the single signal relevant to a particular threat even if the observer is looking specifically for such a signal. Thus, the characteristics of the structural property of noise in a given environment has a significant impact upon the degree of sensitivity toward given signals that can be exercised by even qualified observers.

With regard to Pearl Harbor, Wohlstetter indicates that signals pointing to an attack on the forces there had to compete with a far greater number of more ominous signals pertaining to the European theater that were impacting upon Washington at an alarming rate. The Pacific Command gave credance to numerous signals that pointed to attacks northward against the Soviet Union rather than southward into the Pacific. Tasking of Japanese espionage agents in the Hawaiian area was intercepted, but similar intelligence requirements were observed being levied upon Japanese agents in a plethora of other locations including Panama, Vancouver, Portland, San Diego and San Francisco.

As these examples illustrate, a multiplicity of situations are active simultaneously. What applies to one area may be even more descriptive of another. The variety of signals do not build necessarily in any consistent

pattern that can be discerned without long and careful analysis. Even then, the pattern may become clear only with hindsight. In this regard, the evidence Wohlstetter compiled in her research indicated a significant increase in the frequency of espionage tasking from Tokyo concerning both Manila and Pearl Harbor. If an analyst in Far Eastern Intelligence had noted this frequency and been able to make a comparison to the relative frequency of such tasking for other port cities, this might have added an important piece to the warning puzzle.

Problems of time sensitivity and perishable data

Time factors related to evolving crisis situations have a dual effect on the analysis of incoming data. The dynamics of crises are such that the demand for accurate assessments becomes more pronounced as the crisis escalates. When a multiplicity of events unfolds in rapid fashion, this effect is reinforced to the point where the decision maker's demand for equally rapid analysis exceeds the capacity of the system to sort the facts from what is known about the multiple events. The key fact that would place the need for particular decisions in perspective may not have filtered through the system. Thus, in one sense, the pressures of time related to the degree of urgency for a critical decision contribute directly to the amount of uncertainty with which the analyst still must contend.

Graham Allison in his analysis of the Cuban Missile Crisis provides some classic examples of this effect of time. With regard to one of the principal sources of intelligence on Cuba, refugee reports, he noted that the processing of an individual report might take up to two weeks. While these reports yielded volumes of information, most of it was of low reliability and some of it contained disinformation. Thus, an individual report had to be cross-checked and compared painstakingly with thousands of others before it could be accurately assessed. In another example, he cited the case of a CIA agent in place who observed a strategic missile in Cuba on 12 September. Requirements for clandestine security, protection of sub-agents, and concealment of agent networks dictated that the norm for information from such a sensitive source in Cuba to reach Washington was nine to twelve days. Thus, the estimate produced by the United States Intelligence Board on 19 September that the Soviets would not place missiles in Cuba did not have the benefit of this actual missile sighting.[3]

In another sense, the passage of time often dilutes the continuing impact of key reports upon the current appreciation of the situation. Returning to the agent

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[3]Department of Defense Appropriations, Hearings, pp. 63-64 as quoted in Graham Allison, Essence of Decision: Explain- the Cuban Missile Crisis, (Boston: Little, Brown and Company, 1971), pp. 120-121.

tasking against Pearl Harbor that Wohlstetter reported, the last reference to these requirements was made by the Japanese on 24 September. The fact that a follow on attack by the Japanese against any United States possession did not materialize prior to 7 December may have had a cushioning effect on the continuing impact of the 24 September message. Wohlstetter also cites in the same chapter the reports of the Soviet master spy, Richard Sorge, who had cabinet level access in Japan. In July, he warned that the offensive would be southward. In September and early October, he became even more alarmed about the movements of Japanese forces in Manchuria and predicted attacks against the Soviet Union with such frequency that these radio reports were finally intercepted and fixed by the Japanese Secret Police leading to his capture.

Problems of cover and deception

The fact that most aggressors take active measures to conceal their true intentions prior to launching a sudden attack adds further complications to the threat detection and perception process. The measures taken may be to ensure that pertinent signals remain as quiet as possible, or deliberate disinformation may be made to standout against the general noise. Wohlstetter's work abounds with such examples. Even within the Japanese cabinet, the

plans for the Pearl Harbor attack were known only to the Navy Minister and the Prime Minister, who was also the Army Minister at the time. Japanese commanders in the field were sent false war plans concerning possible action in the China Theater, which were only changed at the last possible moment to coincide with the true southward thrusts that the high command intended. Prior to the departure of the fleet for Hawaiian waters, the Japanese employed both active and passive measures against the United States communications intercept network. They used false transmissions to convince Navy intercept operators that key major combatants remained in Japanese home waters, while the radio silence maintained by the Japanese aircraft carriers precluded tracking by the United States high freqeuncy direction finding network during the latter part of November and early December.

Problems of the defender

The principal problems regarding the defender's perception of the situation as cited by Wohlstetter include those related to security requirements, bureaucratic blocks to communication, organizational status and prestige, and current beliefs concerning enemy behavior. The United States code name for the interception and decryption effort targeted against Japanese communications was "MAGIC". Due to security requirements, MAGIC intercepts were closely held within the United States politico-

military community, i.e., only disseminated to a few key officials. This security requirement thus decreased the number of pertinent signals heard by all responsible parties to the point that those represented by the MAGIC intercepts were barely audible to crucial segments of the system.

Wholstetter believed that the Army/Navy rivalry at the time of Pearl Harbor contributed to their limited sharing of intelligence data and impeded the communication between the services concerning the portions of the intelligence puzzle that each held in-house. She also felt that prejudice at the time against specialists and, in particular, intellectuals within the establishment, made it difficult for these personnel to communicate their assessments to and be heard by the crucial decision makers involved. A more serious factor she cited as being a reflection of prestige was the low budget for the services in the pre-war years. She specifically mentioned the limited resources made available to intelligence in that period as decreasing the amount of success it could have achieved had it enjoyed greater prestige.

Finally, Wohlstetter pointed to the all too human tendency to focus greater attention on signals that conform to current expectations of enemy behavior. She indicated that the belief that Pearl Harbor was an improbable target may have been in itself a key factor in making it

difficult for attack signals to be heard.

Crisis Management

The Sociological/Organizational Aspects

Graham Allison developed the three models shown in Fig. 2 to explain the crisis assessment and decision making process.[4] The basis for his Model I is the concept of a unitary rational actor. Model II he calls the organizational process. Model III is a governmental politics model. He believes that these decision making models complement one another. None provide all the answers. Each frames the questions in a different manner and provides leads to different portions of the picture of a particular decision making process. The models thus reveal how each portion contributes to the total picture.

Problems with Model I analysis

Model I explains a government's choice of an aggregate action by constructing a calculation according to which the government in question might reasonably have chosen to make the particular move. This is a game of maximization under some set of constraints, which finds its basis in modern economics, statistical decision theory and game theory.

While Allison finds the rationality of choice model

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[4] Ibid., "Summary Outline of Models and Concepts", p. 256.

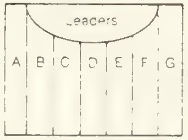
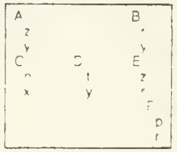
The Paradigm	Model I	Model II	Model III
	National government  Goals (objective function) Options Consequences Choice	National government  Organizations (A–G) Goals SOPs and programs	National government  Players in positions (A–F) Goals, interests, stakes and stands (r–z) Power Action-channels
Basic unit of analysis	Governmental action as choice	Governmental action as organizational output	Governmental action as political resultant
Organizing concepts	National actor The problem Static selection Action as rational choice Goals and objectives Options Consequences Choice	Organizational actors (constellation of which is the government) Factored problems and fractionated power Parochial priorities and perceptions Action as organizational output Goals: constraints defining acceptable performance Sequential attention to goals Standard operating procedures Programs and repertoires Uncertainty avoidance (negotiated environment, standard scenario) Problem-directed search Organizational learning and change Central coordination and control Decisions of government leaders	Players in positions Parochial priorities and perceptions Goals and interests Stakes and stands Deadlines and faces of issues Power Action-channels Rules of the game Action as political resultant
Dominant inference pattern	Governmental action = choice with regard to objectives	Governmental action (in short run) = output largely determined by present SOPs and programs Governmental action (in longer run) = output importantly affected by organizational goals, SOPs, etc	Governmental action = resultant of bargaining
General propositions	Substitution effect	Organizational implementation Organizational options Limited flexibility and incremental change Long-range planning Goals and tradeoffs Imperialism Options and organization Administrative feasibility Directed change	Political resultants Action and intention Problems and solutions Where you stand depends on where you sit Chiefs and Indians The 51–49 principle Inter- and intra-national relations Misperception, misexpectation, miscommunication, and reticence Styles of play

Fig. 2. Crisis Decision Making Models

a good clue to individual behavior, he points to major difficulties that arise when the behavior to be explained is not individual, but one of large organizations. Sociologically, it is even more difficult to apply such a model to the behavior of nations. Thus, with regard to Model I, Allison concludes that "the present hiatus in thinking about problems of foreign affairs derives in large part from attempts to pursue Model I reasoning, without much self-consciousness, as the single form of analysis."[5]

This conclusion recognizes a need to incorporate additional factors. One prime factor is the interplay between individuals within organizations during the decision making process. On the national scale, this would equate to interaction within the politico-military decision making system. Other variations of Model I do bring multiple actors into play, primarily to compensate for the reduced view of the process as being the product of a single unitary actor. Even in these versions, however, the response produced as the result of an initial stimulus, still is viewed as essentially one produced by unitary consensus. Beyond the reality that national decision making is essentially system decision making, the need for additional factors becomes particularly acute

[5] Ibid., p. 254.

when trying to explain behavior associated with implementation of the plan. Thus, while the final decision might conceivably be attributed to unitary consensus, translation of that decision into action requires the participation of numerous organizations and smaller groups within the politico-military system. Model II is particularly relevant to this phase and also illustrates organizational action that poses constraints for the initial decision making process.

Model II analysis

Allison developed Model II using contemporary organizational theory as a basis. In this model, he emphasizes the bureaucratic structure of the government involved in the crisis. The model seeks to identify which components traditionally act upon the type of problem precipitated by the crisis concerned and to determine what is the relative influence of these components within the government. Once these components have been identified, the model examines the repertoires, programs and standard operating procedures that each has for disseminating information about the problem to decision points, for generating alternative courses of action, and for implementing these courses of action.

Model III analysis

In model III, Allison incorporates consideration of

governmental politics into his analytical framework. The model examines the channels for producing action on the problem concerned and focuses on the participating players to determine how job pressures, past stances, and the personality of the various key actors affect the execution of their roles in the crisis management process. Then the model is used to determine what deadlines will force the issue and what foulups might result. Thus, time factors and situation dynamics are also brought into play.

Contributions of the models

Model I's utility is that it fixes the broader context within which reactions to the crisis may be viewed. This includes the larger national patterns and the shared images of the decision makers involved. Model II operates within this context to highlight the organizational mechanisms that produce the course of action. These mechanisms include those that produce the information defining the problem, those that formulate and propose alternative solutions, and those that are charged with the implementing process. Model III adds further refinement to the process through the development of detail concerning the principal leaders of the government and the politics between them.

Allison's application of the models was for post-crisis analysis. He was thus able to take advantage of historical data to gain his insights. These sources were

rich and abundant with regard to United States decision making and the intelligence that supported that effort. The same could not be said for the conduct of the same processes by the Soviet politico-military system. In particular, his comments with regard to interaction pertinent to Models II and III had to be inferred from the historical events that represented the results of that interaction, rather than from intimate knowledge of the interaction itself.

Use of the models in a current crisis situation to determine how an adversary might react to the evolving situation poses an entirely different problem. Employment of the rational decision making model would have to be made with care to ensure that the rationality used was that appropriate to the adversary's culture and way of thinking, rather than using a mirror image of one's own appreciation of the situation. The data required for employment of Models II and III is extremely difficult to collect from a closed system such as the Soviet Bloc. This is not to imply that the United States Intelligence Community does not collect information relative to the concepts expressed in the Allison analytical framework, only to imply the difficulty of penetrating the Soviet system with regard to these requirements. Every bit that becomes available is collected and analyzed as the opportunity presents itself. Analysis of the organizational

process within the Soviet military-industrial complex has received particular attention in conjuction with technological forcasting efforts, while political and military personalities are the principal subjects of an extensive biographic intelligence collection and production effort conducted by the community.[6]

The Politico-Military Aspects

Examples pertinent to Allison's models are included in the discussion that follows concerning the politico-military aspects of the crisis management process. These examples are intended to highlight some of the constraints that channel both decision making and implementation efforts toward particular courses of action in a crisis situation. The discussion addresses the following problems: political pressures, organizational inertia, influence of the participants, alliance commitments, military capabilities, strategy and doctrine, and crisis management imperatives.

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[6]For an example of the role of bureaucratic organizational analysis in technological forecasting, see Dimitry N. Ivanoff and Frank M. Murphy "A Methodology for Technological Threat Projections of Soviet Naval Antiship and Surface to Air Missile Systems",Paul J. Murphy, ed., Naval Power in Soviet Policy, (Washington, D.C.; United States Air Force, 1978), pp. 136 - 137. Similar work incorporating a more detailed emphasis on the bureaucratic structures and politics of the Soviet research and development community has been conducted at the Naval Postgraduate School since 1975 under the direction of Professors Russell H. Stolfi and Peter C.C. Wang.

Political pressures

The Kennedy Administration was in a particularly vulnerable position with regard to the Cuban situation in 1962. The failure of the Bay of Pigs had left them seeming indecisive and public consciousness relative to United States security interests vis-a-vis Cuba had been heightened. The Republicans were quick and long at pointing to his Bay of Pigs failure and to the need for sterner measures concerning the current Soviet military buildup in Cuba.

Allison cites the Republican reaction to the evolving events as the classic illustration of the effect of the "backdrop". In this instance, it took the form of the loyal opposition and Congressional committees on policy making.[7] The Administration became pinned down on the issue of a response to the Soviet initiatives narrowing the President's options to the point where he had to decide to go beyond responding with only diplomatic moves.

Organizational inertia

President Kennedy may have believed that he was a unitary decision maker and that all of his decisions would be translated into comparable action. Prior to the Cuban Missile Crisis, he twice had ordered the removal of Jupiter medium range ballistic missiles from Turkey. He was

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[7]Allison, Essence of Decision, pp. 189-190.

absolutely dismayed when during the crisis he discovered the missiles were still in place. Politico-military maneuvering between United States government agencies and Turkey was the cause. This included significant political pressure by Turkey to maintain the missiles' presence. Given this circumstance, he was now faced by the question: If he struck the Cuban sites and the Soviets replied in kind in Turkey, would he be forced to escalate the situation more rapidly? Had the Jupiters been removed in accordance with his orders, this issue would no longer have been relevant to the current crisis.[8]

Influence of the participants

Robert Kennedy and Robert McNamara were gravely concerned over the potential nuclear consequences of the situation. Would this be the time that Khrushchev would force an insane reaction bringing severe consequences to the entire world? On the other side of the issue were the Joint Chiefs of Staff, who believed that now was the time to deal with the issue of ridding the Americas of Castro's Communism. Other advocates of military action, such as Dean Acheson, Paul Nitze, Douglas Dillon and John McCone, saw the security of the United States and this nation's leadership of the free world as the issues dictating prompt and effective action. McNamara began the argument for the

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[8] Ibid., p. 101.

blockade. He was joined by both Robert Kennedy and Theodore Sorenson. It was these three men with whom the President had the greatest affinity. This affinity, added to the belief by the Joint Chiefs that a surgical air strike was impractical because there were no guarantees that all missiles would be neutralized, plus consideration of the military alternative of massive offensive action, all lead to the active consideration of a blockade and its eventual implementation.[9]

Alliance commitments

Ole R. Holsti, one of the principal researchers investigating international interaction during crises over the last thirty years, points out that alliance commitments are another factor that can compound an immediate situation. Such commitments may present a "heads you win, tails I lose" dilemna. Holsti feels that two separate distinctions should be made by decision makers with regard to such commitments. First, he strongly believes that pre-existing commitments should be differentiated from those desperately taken to bolster the credibility of one's own policy. Second, and more important, he states that pledges to nations both willing and able to defend their own security should be taken more seriously than assistance offered to nations with an absence of will, capabilities

[9]Ibid., pp. 197-208.

and popular support. Thus the relevant issues with regard to alliances are where and when to take the stand.[10]

Military capabilities

Holsti also points out that military capabilities, be they either awesome or vulnerable, contribute significantly to the intensity of a crisis situation. With regard to the attributes of modern weapons of speed, range and destructive capacity; he believes they stimulate an inclination for a first strike in order to destroy the adversary's capacity to respond. Vulnerable forces, on the other hand, provide no incentive to policy makers whatsoever to delay a response. The pressure is to employ them before they are destroyed by the enemy. He also cautions that policy makers must recognize that the military in providing advice have the responsibility to project beyond the confines of the current situation to what should be done should the crisis evolve to actual hostilities. Thus, they must plan so that their forces will not be caught at a disadvantage and must seek actions that will gain the advantage over the other side, or at least neutralize enemy forces before it is too late.

Factors that Holsti believes can mitigate against these pressures include increases in quantities of

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[10] The examples presented by Holsti in this chapter were drawn from his section on "Policy Options" in Crisis Escalation War, (London and Montreal: McGill-Queen's University Press, 1972), pp. 204-237.

weapons, dispersal of forces, hardening of retaliatory sites, concealment and mobility of strategic weapons systems. He goes further to state, however, that while these steps may be necessary for deterrence; he does not regard them as sufficient. The key factor does not depend upon the capacity of a nation's forces, but on the intentions of the nation's leaders with regard to their use. He believes that policy makers must perceive that the risks of immediate military response in a given situation are outweighed by the value of a delaying strategy. They must also credit their adversary with the same perception. Otherwise, an inclination for haste in employing the military option will only be reinforced by the perceived military capacity to achieve one's objectives or secure the initial advantage.

Strategy and doctrine

These factors can act as serious constraints on the numbers of options that policy makers have available to them. This proposition goes directly back to Allison's Model II. The capabilities and programs developed by the military are tied directly to the prevailing strategy and doctrine. Evolving technology also contributes by rapidly rendering current plans and programs obsolete. Thus, the repertoires and standard operating procedures in place may not provide the policy maker with flexible

response in a crisis. Holsti contrasts the locked step escalation tied to the prevailing strategies and doctrine in 1914, which led to World War I, with the wide range of means that both President Kennedy and Premier Khruschev had at their disposal to convey their will and intent without provoking direct nuclear confrontation in 1962.

Defensive strategy and doctrine are plagued with particular problems. Wohlstetter points out that both intelligence predictions may be in error and enemy moves may be reversed when detected. These factors exact a heavy price on the capacity of the defense to react to every indicator. Full alerts are costly measures. Their continuous exercise not only dissipates available resources, but also they detract from the significance attached to succeeding alerts by participating personnel.[11] Strong defensive action, on the other hand, may be taken by the enemy as an overt aggressive act. In 1914 according to Holsti, the act of mobilization meant war as the next logical step in the escalation process. Thus, this option was denied effectively to the decision maker who conceived of it as a defensive measure to indicate preparedness to an adversary.

Crisis management imperatives

Holsti offers six imperatives which he believes

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[11] Wohlstetter, Pearl Harbor, pp. 394-395.

lead to effective crisis management. The first is that sensitivity should be directed toward the enemy's frame of reference. This means empathy, not appeasement. Such sensitivity should include consideration of the following factors: his motivation, possible bureaucratic pressure that may impinge upon his decision making, and operational codes that may dictate his strategies. The second imperative he believes is the real diplomatic test. Do not take steps that will seal off escape routes. Related tasks include convincing the enemy that gestures of goodwill are genuine and devising stragegies of coercive diplomacy that precipitate deescalation, rather than escalation. The third imperative reinforces the second. Remember that reducing the enemy's incentive to escalate will probably require both threats and inducements in combination to produce the desired effect. The role of deterrence is to convey to opponents that certain options are unacceptable, while that of diplomacy is to define the alternatives and persuade the opponent that these are in his self interest. The fourth imperative directly supports the third. In crisis diplomacy, as in other forms of communications, actions tend to speak louder than words. For maximum impact it is useful to orchestrate declarations of intent and action. In doing so, employ multiple channels of communication to convey the same message whether it is one of deterrence, conciliation, or a

combination of the two. The fifth imperative relates to the intense pressures decision makers feel in the crisis environment. Both sides should make every effort to slow the pace of events. The sixth imperative is that responsible policy makers should be in control of not only strategic decisions, but also of the details of implementation. This dictum is to ensure that those who must implement the decisions are in consonnance with and do not detract from formulated objectives, strategy and tactics when executing the policy maker's orders.

Holsti remains optimistic that crisis management can proceed rationally. He concludes by outlining factors that make a crisis manageable:

> "In summary, the pressures of time in crisis and consequently the probabilities of uncontrolled escalation, may be reduced if both sides possess weapons capable of withstanding any first strike, if military doctrines stress the importance of delay rather than haste in the employment of military force, and if both sides possess sufficiently varied capabilities that each military deployment need not be interpreted as a prelude to attack."[12]

The Systems Approach

Definition of a System

A system is a holistic concept. The key to its organization is based upon the interrelationships between the whole and its separate component parts and between

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[12] Holsti, Crisis, p. 237.

the individual component and all other components. A system is conceived in terms of a holistic organization whose parts are arranged or positioned within a dimensional domain. It is not a question of whether the whole is greater than its parts, for this implies an aggregating process. System formulation is of an entirely different genre. In aggregates, it is significant that parts are added. In systems, it is significant that parts are arranged. The dimensional domain not only separates the parts, but also it particpates in the formulation of the system. Thus, the system cannot be derived from its parts because it is an independent framework into which the parts are placed. The parts do not enter into connection based upon their inherent qualities, but primarily by means of their positions within the system. It is the fact that parts participate on the basis of their positional value rather than their inherent qualities that makes the whole relatively independent from the nature of its parts. The relevance that the inherent qualities of the parts takes depends upon the requirements for specific attributes. In fact, while some attributes of a part make it particularly suitable for a position within the system, other attributes that it may possess may be entirely irrelevant to the needs of the system. The greater the organization of the whole, the greater the role the inherent qualities of the parts assume toward becoming

co-determinates of positional values. The concepts of the whole and the system are distinguished as follows: The whole designates the concrete, organized object. The system is the organization itself, the way of arranging the parts.[13]

Systems Analysis

C. West Churchman, a principal advocate of the systems approach, states that its purpose is as follows:

> "The management scientist's aim is to spell out in detail what the whole system is, the environment in which it lives, what its objective is, and how this is supported by the activities of its parts."[14]

Churchman goes on to outline five basic considerations that one must keep in mind when seeking the meaning of a system. These included (1) the total system's objectives and performance measures; (2) the system's environment, the fixed constraints; (3) the resources of the system; (4) the components of the system, their activities, goals and performance measures; and (5) the management of the system.

System objectives

Churchman contrasts two categories of system

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[13] These concepts were developed by A. Angyal and are found in "A Logic of Systems", Fred E. Emery, ed., Systems Thinking, (New York: Penguin Books, 1978), pp. 17-19.

[14] The purpose of and analytical criteria for the systems approach were extracted from C. West Churchman, The Systems Approach, (New York: Dell Publishing, Inc., 1968), pp. 29-30. Churchman's discussion of the analytical criteria continues through page 47.

objective, the stated versus the real. This dichotomy corresponds to the sociological concepts manifest and latent, which normally apply to the analysis of functions. Real objectives may become obscured by stated ones due to the motivation of the organization and its spokesmen. The stated objectives are usually couched in such terms so as to make them as palatable as possible to the public or whatever audience in the environment from whom the organization is seeking support. The best way to distinguish between the stated and the real is to focus upon the system's activities rather than relying exclusively on the pronouncements of its spokesmen.

As illustration of these concepts, Churchman offers the following examples: The stated objective of a medical laboratory might be to make as accurate tests as possible. The real objective relates to the purpose for striving for accuracy. This is to assist the physician to arrive at the proper diagnosis of his patient's problem. A university president appears before the legislature and speaks of the quality of his institution, his distinguished faculty, and the service faculty research renders to the public. He speaks in prestige terms in order to obtain as large a share of the budget as he can. The primary purpose of his institution is not, however, to develop quality facilities, produce distinguished faculty, or promote faculty research. It is to educate the

generation reaching adulthood that will replenish the professions of the society. Fortunately, in this case, the stated objectives are necessary to achieving the real objective; but they may not be sufficient.

He also makes an important distinction between the real and legitimate objectives of a system. Legitimate objectives are related to the morality and ethics of a system's practices. For an objective to be legitimate, it must be consistent with the welfare of the society of which the system is but one part. Above all, the practices the objective fosters must not breach the ethical values of that society. The formulation of legitimate objectives, thus, requires expansion of consideration beyond what might be considered as efficient performance measures. Churchman regards it to be irresponsible to limit performance measure consideration to questions of efficiency because this fails to perceive the total impact of system activities upon the society. Legitimate objectives must be made explicit in order to achieve satisfactory ways of thinking about the ramifications of the system's activities for society in general.

The following example illustrates these concepts: The performance measures for a freeway system are designed in terms of the numbers of cars that may pass over specified segments of that system in a given period. While such measures may be efficient from a quantitative point

of view, they do not take into consideration the social costs in a qualitative sense. These costs of achieving the required thruput can be measured in such terms as the number of potential accidents, the amount of potential congestion, and the ugliness of the freeway systems per se. All are part of the social equation. These factors thus place the engineering performance measures in proper perspective. Churchman believes it only to be a rationalization to state that these costs are elusive and cannot be defined with precision. He states that they must be considered in the calculation.

The environment

The concept of the environment might be best illustrated by the use of a Venn diagram from set theory as shown in Fig. 3. The environmnet is contained by the box and includes everything that lies outside the circle that circumscribes the particular set that represents the system concerned, set A in this case. Thus the environment lies outside the system. It includes not only physical characteristics and properties, but also competing systems. In this regard, the environment may be thought of as a larger system with numerous subsystems as components. In Churchman's terms, the environment provides the things and activities with which the system must deal. Although these may vary in form and degree from time to time, from the individual system's point of view, they are fixed over a given time period.

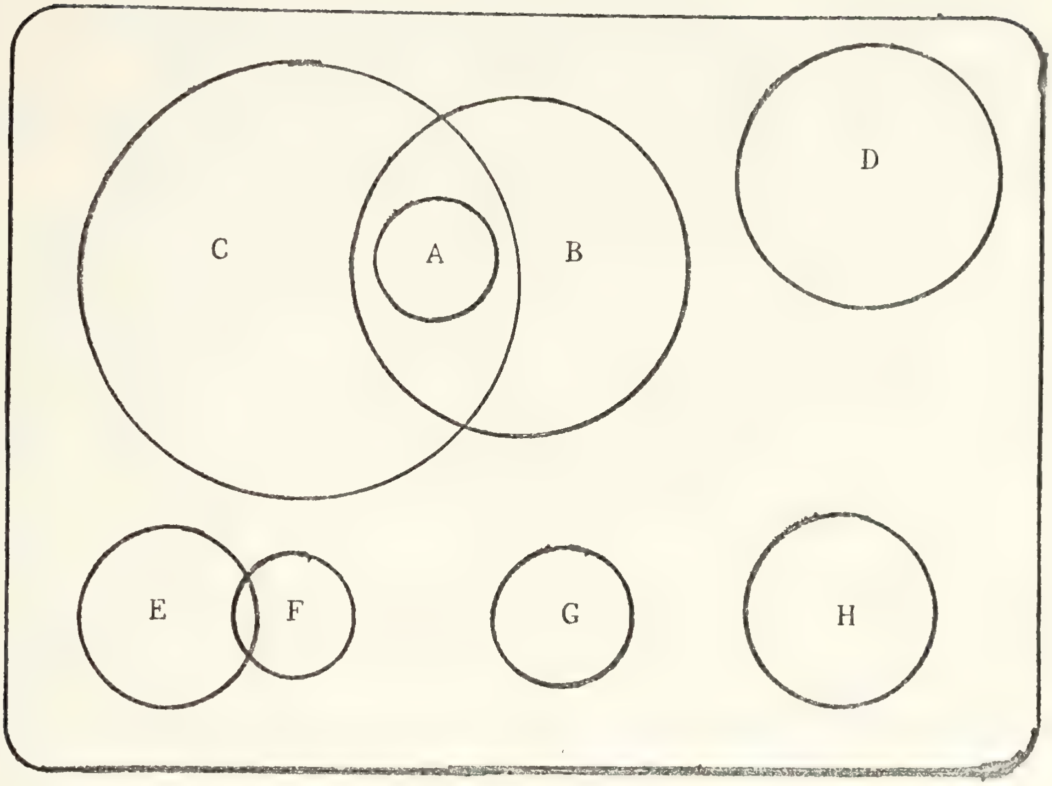

Fig. 3. Systems and Their Environment

Systems thinking is expansionistic. When considering a problem, the system's analyst regards it as a component or subsystem of a larger system. Then he expands the scope of his inquiry to consideration of the larger system to determine its relationship to the given subsystem and the interrelationship among all subsystems involved. In Fig. 3, the problem might be represented by set A. This component is a subsystem of both the larger interlocking systems represented by the intersecting sets B and C. Logically, the inquiry could continue to be expanded to the limits of the environment, perhaps the

universe. In this case, that would include consideration of sets D through H and the null set. It probably would be sufficient, however, to limit consideration of A's environment to that contained in sets B and C as having the most direct influence over the structure, content and activities of A as a functioning system. The analysis would also include examination of the components of A, their structure, content and activities within that system.

Inferences concerning the environment's influence upon the individual systems it contains also may be drawn from Fig. 3. The aggregation of resources and activities stemming from the numerous larger and competing systems in the environment will always outnumber the resources and activities that any one individual system can employ and conduct. The greater weight of these multiple resources and activities establish natural constraints upon the individual system to act legitimately in accordance with the goals and objectives that are prevalent within the given environment.

Some examples of how the fixed constraints established in the environment act to influence the structure, content and activities of individual systems include the following: A naval commander may have to limit the extent of his operations due to the meteorological and sea conditions forecasted for a given period. If he is conducting

amphibious operations, the number of men and material that may pass over the beach in a given period will be constrained by the physical characteristics of the beach or harbor and its approaches. The adversary's military system with whom the commander must compete will also limit accomplishment of his objectives to the extent of the number and kinds of forces that the adversary system has allocated to defend the beach. The commander has competed in turn with other components within his military system for the resources he has available to him for the operation. These resources have been allocated by higher decision makers within that system. The amount these decision makers had to allocate to all of their component subsystems depended upon fixed constraints established by the still larger political system such as budget controls set in law for the given period.

System resources

As noted above, the system has to compete within the environment for the resources that it acquires. Once these are obtained, however, the decision makers controlling the system have discretion over how these resources will be allocated to and employed by the activities of the component subsystems. Allocation decisions are based upon how these resources can be employed most efficiently and how they can be developed to ensure expanded

capabilities for the system. Churchman views resources as not only the people and material available to the system, but also as other factors that do not appear in the balance sheets such as the educational background and professional skill of the personnel concerned, the goodwill the system has established within the environment over time through its activities or lack of such goodwill, and the opportunity costs of selecting various courses of action over potential alternatives. These other factors add or detract from the effort as the system's basic resources are employed and developed through its activities. In summary, to Churchman, resources are the general reservoire out of which specific actions of the system are shaped.

Subsystems

In discussing the components of a system, Churchman avoids focusing on traditional organizational structure. He prefers instead to emphasize functional definitions of these components that relate the activities of each part to specific missions, jobs and tasks assigned for the pursuit of the system's goals. He believes that it is only in such a manner that the worth of subsystem activities can be measured. Further, he states that it is critical to know if the activity of one component is better than the activity of another component. The measure

of performance must be assessed in terms of how component activity increases the overall performance of the system. When performance measures of components are established separately without due regard for their consistency with total system objectives, this stimulates component competition for system rewards at the expense of other components and the system itself.

Management of the system

Management functions to perform three broad areas of responsibility according to Churchman. These include setting the system's goals, allocating its resources, and controlling the performance of the system to achieve its objectives. Management establishment of subsystem goals has to ensure consistency with the system objectives if the subsystem goals are to be constructive ones. Since resources are limited, they must be allocated to permit subsystems to achieve their established goals in such a manner that will optimize total system performance. If the goals of the subsystem are not within the capabilities of its allocated resources, either the resource allocation must be reassessed or the subsystem goals must be adjusted downward to be more realistic.

Control relates to the monitoring and evaluating of the performance of the system and its separate components. Churchman believes this to be the most critical aspect of

management. He points out the difficulties of devising a plan that establishes perfectly correct objectives, takes into account all environmental factors, precisely allocates all resources, and recognizes the ultimate functions of all components. Essential to the control function is the cybernetic loop through which information concerning system performance is fed. The flow of information through this loop must be both timely and accurate for the system to perceive and react in an optimal fashion by implementing adjustments to the plan that may be required. In this regard, Churchman points out that control implies not only considering whether the system is operating according to plan, but also, and even more critical, whether the plan itself remains a realistic pursuit of system objectives.

The management system

Turning once again to another primary researcher in the systems field, Russell L. Ackoff, management itself is regarded as a system. Paralleling the Churchman discussion above, Ackoff asserts that the management component of the system serves to perform four funcitons: (1) identify problems, (2) make decisions, (3) control the decisions made, and (4) provide the information required to perform the first three functions. Fig. 4 diagrams the model he developed to show the four basic components of

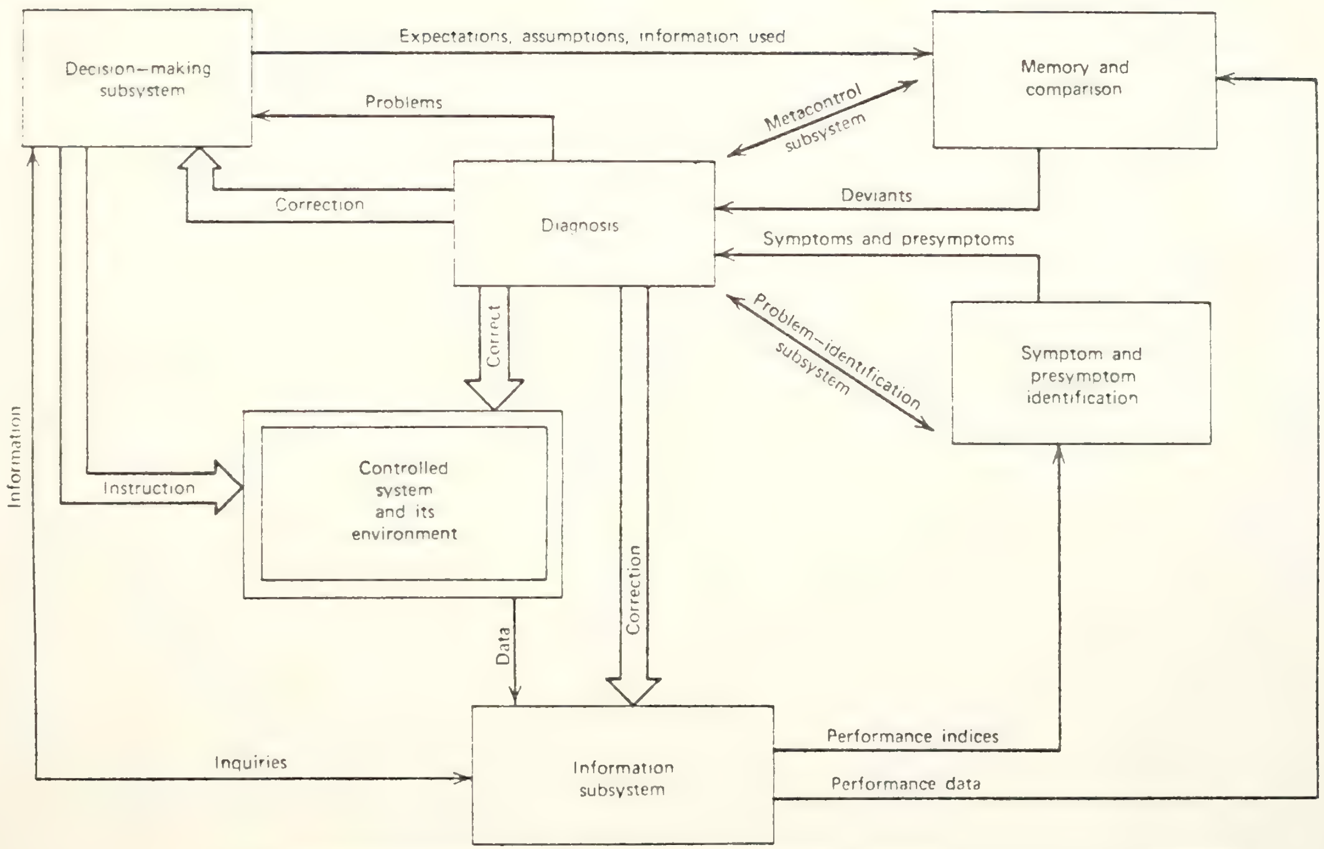

Fig. 4. Schematic Diagram of an Adaptive-Learning Control System

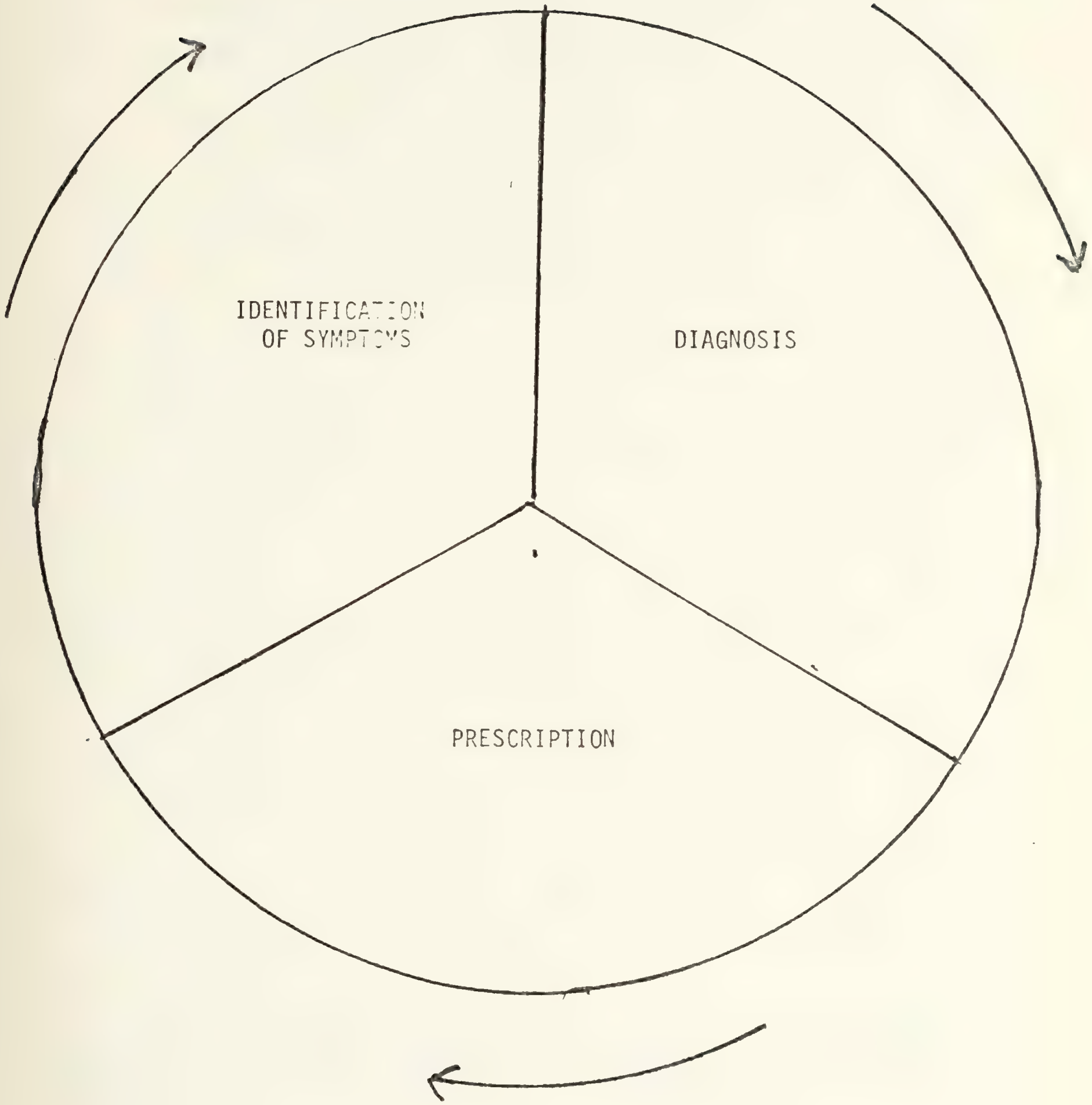

Fig. 5. The Decision Cycle

the management system and how they function. These components include: (1) the decision-making subsystem. (2) the information subsystem, (3) the problem-identification subsystem, and (4) the metacontrol subsystem.[15]

These four subsystems function to complete the processes that are associated with the decision cycle of an adaptive learning control system. This cycle is shown in figure 5.[16] The evolution of these processess is stimulated by plans for pursuit of system objectives that are formulated by the decision-making subsystem. These plans should not only establish the milestones leading to each objective and the performance measures associated with each milestone, but also the expected effects of these milestone decisions in terms of the problems anticipated while proceeding toward each milestone.

The role of the information subsystem in these processes is to generate performance indices and data that will assist the identification of symptoms and presymptoms. Ackoff defines a symptom as a deviation of a system's behavior from what is considered to be normal behavior.

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[15] See "The Components of a Management System", Appendix in Russell L. Ackoff, Redesigning the Future, (New York: John Wiley and Sons, 1974), pp. 229-236. Fig. 4 was taken from p. 230.

[16] The author based the illustration of the decision cycle shown in Fig. 5 upon Ackoff's definition of that cycle in Russell L. Ackoff, A Concept of Corporate Planning, (New York: John Wiley and Sons, 1970), p. 124.

Presymptoms, he calls omens. These are predictors of future symptoms. The technology that can be programmed into the information system to detect and provide alerts to such deviations is that of both statistical and quality control. Other factors that may be programmed into the system include analysis of past and current performance of the system being controlled, the performance of other systems like it for the sake of comparison, and data concerning the environment of the controlled system. While Ackoff does not hesitate to point out that the programming of this technology and these factors might be within the capability of current automated systems; this does not imply that the selection of proper performance measures and indices for use in symptom surveillance can be automated. This selection effort requires the application of enlightened human judgment.[17]

The identification of the problem by that management system component is built upon the symptom/presymptom identification process. The next step in the process requires comparison of the actual state of affairs reported by the information system to the anticipated state of affairs projected in the plan. This memory and comparison step is the function of the metacontrol subsystem. Mismatches of expectations and actual outcomes are then explained. The symptom identification and comparison steps form the

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[17]Ackoff, Future, p. 231.

diagnosis segment of the decision cycle.

The process of prescription, which completes that cycle, is the responsibility of the decision-making subsystem. This effort entails transformation of decisions into instructions or directives that are implemented by the components of the controlled system to deal with the problems identified in accordance with the current diagnosis. The information subsystem can assist this process. It can be employed as a device for transmitting the instruction, monitoring the effect of its implementation, and providing feedback through the problem identification and metacontrol subsystems to the decision-making subsystem concerning the results of the problem solving effort. The solution sought is the optimal. This is defined by Ackoff as consisting of those values of the controlled variables that, within the specified constraints and under the relevant uncontrolled conditions, yield the best performance of the system.[18]

Systems involved in international crises

Fig. 6 applies these system concepts to analysis of nations participating in international politico-military activities. The circles denote the systems of the nations involved, while the boxes represent the environments of

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[18]Ibid. p. 233.

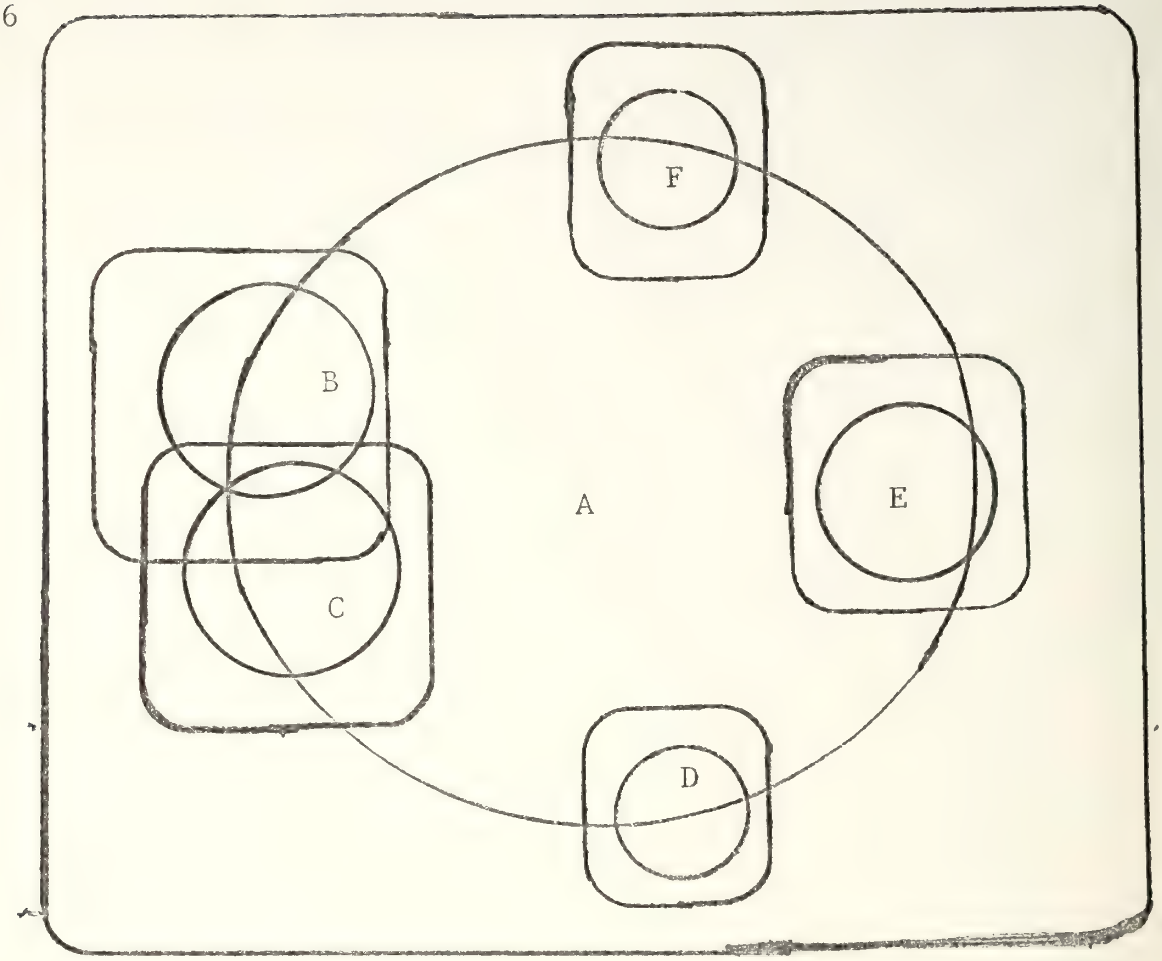

Fig. 6. The International Politico-Military Environment

A - The international politico-military activities system

B & C - Two national politico-military systems involved in a crisis

D through F - Other nations participating routinely in international politico-military activities

these individual systems. Two basic types of systems are illustrated in the figure. The large system A is the system of international politico-military activities. Its environment includes all the nations of the world. While each national politico-military system and its environment is in the international politico-military environment, the politico-military activities are divided between those conducted within the international politico-military activities system (A) and those conducted internally within their own national politico-military environments.

For purposes of illustration, the intersecting sets B and C represent two nations involved in an international crisis. The national politico-military systems represented by sets D through F are not presently involved in the crisis. Thus, the situation of each individual nation can be considered a fluid one as it moves through the international politico-military environment. At times it interlocks with the politico-military system of another nation and tensions heighten. Most of the time, hopefully, such interlock does not occur and the nations of the world participate in international politico-military activities on a more routine basis.

Note that not only do the systems of nations B and C interlock when in a crisis situation, but also the environments of these national politico-military systems intersect. This fact illustrates a significant difference between the

problem situation confronting the management subsystem of these two contending national politico-military systems and the problem situation addressed by Ackoff and shown in Fig. 4 on page 41. The latter problem situation is applicable to a closed system and its open environment. Essentially the management subsystem in this case formulated a plan of action and then controlled component activities to conform to the plan of action. The process included monitoring of the performance of the activities of the controlled system and its environment to detect deviations from the plan, diagnosing the problems they pose to system objectives, and issuing prescriptions to components of the controlled system to take corrective action.

In the international crisis case, the politico-military systems of the two nations involved are closed systems subject to the control of each nation's respective management subsystem. Portions of each nation's national politico-military environment during the period of the crisis, however, include portions of both the opposing nation's politico-military environment and politico-military system. Since it lies in the first nation's environment, the politico-military system of the opposing nation is not subject to the control of the first nation's management subsystem. Further, because the system of international politico-military activities is also part of both nations' larger environment, it is not subject to the

control of their respective management subsystems.

Thus, the management subsystem of a national politico-military system operating within the system of international politico-military activities must monitor the performance of the system it controls. Further, it must monitor the performance of other nation's politico-military systems as they operate within the system of international politico-military activities. Finally, it must monitor other factors and activities within the international politico-military environment. The presympton/symptom identification process necessary for the detection and diagnosis of problems associated with crises in their nascent phase is a significantly complex effort. The management subsystems of individual nations are confronted with the activities of numerous uncontrolled systems rather than having only to monitor and diagnose problems relative to their own controlled systems and the environment in which these single systems operate.

Management Information Systems

Design Criteria

Ackoff believes that designers of management information systems frequently make assumptions about the functions of these systems that contribute to the inability of many to provide the support the manager needs in practice. He outlines five erroneous assumptions as follows: (1) The

need is for more information. (2) The manager needs what he wants. (3) The supplying of information improves decision making. (4) Information increases communication. (5) The manager does not have to know how an information system works, only how to use it.[19]

The need is for more information

The manager is much more likely to suffer from an overabundance of information that stifles his ability to perceive and respond to the relevant. Two of the most important functions that an information system can provide are filtration (or evaluation) and condensation. While the information system must highlight the relevant to be efficient, Ackoff also points out that it must be capable of processing unsolicited information as well as the information specifically solicited by the manager. Thus, to provide information required to deal with the current problem, the system must also contain information relevant to the essential context of problems with which the manager may have to deal. This further implies that the system be capable of sorting out information relevant to the current problem from the data base constructed to contain information relevant to the entire context of problems.

With regard to crises, Holsti addresses the questions of how to define both information needs relevant to the

[19]Ackoff, Corporate Planning, pp. 113-122.

context of problems and the information relevant to the given problem. Carrying the assumption of information overabundance one step further, he states:

> "At minimum, sound judgments about intentions and motives require adequate information... The problem of information, then, is more likely to be qualitative than quantitative...Perhaps even more important than raw information is a valid theory to give it meaning and relevance; rarely do the facts speak for themselves. A single fact or even a set of data is usually consistent with several theories. It is quite probable that most international disasters can be traced not to the inadequate information, but rather to the absence of adequate models into which to place the facts."[20]

Holsti here is expressing the need for a framework for analysis that assists sorting the information relevant to the given problem from that contained in the data base. Such an analytical framework should be based upon the critical information requirements of the manager if it is to be successful in contributing to effective organization of the information within the data base. The sort process should start with information parameters that can be attributed directly to the requirements of the given problem. This process should also include the capability to expand upon this initial query and retrieve additional data as new parameters of the problem are perceived and come into play.

The manager needs what he wants

Ackoff contends that one cannot specify what

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[20] Holsti, Crisis, p. 206.

information is required until an explanatory model of the decision process can be constructed and tested. One must take into account the other management system components if he is to be successful in designing an effective information system component. Thus, the development of a valid information theory that specifies information requirements and provides a framework for analysis also requires modelling of the entire decision cycle that highlights the functioning of the other components of the management system beyond addressing only the functioning of the information system alone.

The supplying of information improves decision making

Decision making does not automatically improve as a result of the information supplied to the manager. The problem is that the information provided may suggest many alternative solutions. Even if provided with perfect and complete information, the manager may not be able to rely upon his judgment and intuition alone to optimize his choices of courses of action from the many alternatives indicated. A key to assisting the manager to perform when faced with this kind of a dilemma is determining first how well the particular manager uses information. The information system should be designed to provide him feedback concerning how well he is performing and, in particular, how the implementation of his decision is contributing to

resolution of the problem. If provided with such a capability, the manager can identify his mistakes and learn from them.

Information increases communication

Ackoff believes that this assumption relates to an organizational effect of information systems. He states that the assumption implies that more information provided to the components of an organization will increase automatically the communication among them. He extends the assumption to mean that more communications means better performance by the separate components. In this regard, he warns that organizational components may have inappropriate performance measures that stimulate competition among them for rewards and detract from the accomplishment of organizational objectives. Better communication between components in such a case may not help overall performance. In fact, it might well hinder it by making the components more knowledgeable concerning the status of the competition and reinforcing the drive to achieve the reward at the expense of other components.

The manager does not have to know how an information system works, only how to use it

Ackoff believes that it is imperative that an information system should never be installed unless the management it serves understands how it operates well enough to

evaluate its performance. Management must control the computer and not be subject to control by the system.

Serving the manager

Summarizing the concepts developed to date, it can be said that the information system that best serves management is one that generates indicators and performance data that permit detection of problems at the symptom and presymptom stage. Further, it provides the capability to compare actual performance and outcomes with that projected in the plan. This process is accomplished by organizing the data base on the basis of specified information requirements and developing information management theory that both provides a framework for analysis and models the functioning of all management system components. Such an information system will include sort capabilities that allow focusing on the parameters directly attributable to the current problem with additional capabilities to expand the retrieval to capture information relevant to new parameters of the problem as they are perceived and come into play. Thus, with regard to Ackoff's model, the information system serves as management's institutional memory and consciousness to increase the sensitivity with which the management system can perceive problems and opportunities. Further, it serves to increase the sensibility with which management responds to the reaction that has transformed the controlled system's

internal state as a result of stimuli generated by both that system's activities and activities in the environment.

An Information System for Crisis Management[21]

The information management theory

Charles A. McClelland working at the University of Southern California developed the relevant information theory upon which one of his associates later based a proposal for a technological solution to the crisis decision making problem. In contrast to Allison's study of the internal characteristics of nations in crises, McClelland's work examined the patterns of interaction that nations establish in their relations with one another. He expressed the view that nations responding to one another develop a pattern of escalation that eventually leads to situations called crises which neither of the nations involved want or can control. McClelland theorized that empirical indicators could be identified that would signal when nations were preceeding down the path toward a crisis. Thus, warning to the decision makers involved could be provided if such indicators were detected and perceived in the nascent phase of a crisis.

Design criteria

In seeking to operationalize McClelland's theory,

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[21]Ronald G. Sherwin, "A Computerized Aid for International Crisis Management" The Journal of Technology Transfer, Vol. 5, No. 1, Fall 1980, pp. 51-68.

Ronald G. Sherwin developed and proposed a computer based system that could serve as a crisis monitoring and analysis aid. The McClelland-Sherwin focus on the detection of indicators parallels the concepts expressed by Ackoff in the form of symptoms and presymptoms. Sherwin further designed his system to support ad hoc research efforts that analysis and managers perform while seeking to diagnose and resolve crisis induced problems. He also foresaw the need for the system to function as a tool for the policy maker to monitor and convey the impact of his decision upon the resolution of the crisis.

<u>The framework for analysis</u>

Sherwin believes that coping with a crisis must be formulated to fit its individual parameters and no single off-the-shelf theory can be relied upon to explain all the unique aspects of a given crisis situation. Therefore, the information system supporting crisis decision making must contain information that is as unconstrained as possible by any apriori assumptions about the dimensions of the next crisis. He relied upon the descriptions in the public media to provide near real time information concerning international politico-military activities. He used three principal sources to cross validate one another and prevent the generation of false alarms: the Los Angeles Times, the New York Times, and The Times (London).

He bases his analytical framework upon the concept

of the "INTERNATIONAL EVENT". This he defines as "a discrete instance of an official(s) of one country doing something to another country's official(s) in an effort to influence the second country's policies."[22] He visualizes three other elements to be documented with the event description in each record. These were DATE, ACTOR and TARGET. Actors and targets represent the nations involved in interaction. Recording of the date allows the records to be appended to the file sequentially on a daily basis without disturbing any of the previously collected information. This satisfies the design criteria for unconstrained storage and organization of the data. Date documentation further assists the retrieval of other records in the same time frame that may be relevant to the event under consideration once its parameters have been identified.

The analytical framework is then completed using coding rules that seek to render events mutually exclusive. The completed schema, shown in Table 1, encompasses 63 distinct types of governmental interaction that can be broken down into 22 general event categories. Qualitative data is included in each record and takes the form of a five line textual summary. This summary ensures that the context of the event is retained in the system.[23]

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[22]Ibid., pp. 54-55.

[23]Table 1 was extracted from Ibid., Fig. 2., p. 58.

TABLE 1

EVENT CATEGORIES

1. YIELD
   - 011 Surrender, yield to order, submit to arrest, etc.
   - 012 Yield position, retreat evacuate
   - 013 Admit wrongdoing, retract statement
2. COMMENT
   - 021 Explicit decline to comment
   - 022 Comment on situation-pessimistic
   - 023 Comment on situation-neutral
   - 024 Comment on situation-optimistic
   - 025 Explain policy or future position
3. CONSULT
   - 031 Meet with; at neutral site, or send note
   - 032 Visit, go to
   - 033 Receive visit, host
4. APPROVE
   - 041 Praise, hail, applaud, condolences
   - 042 Endorse others policy or position give verbal support
5. PROMISE
   - 051 Promise own policy support
   - 052 Promise material support
   - 053 Promise other future support action
   - 054 Assure; reassure
6. GRANT
   - 061 Express regret, apologize
   - 062 Give state invitation
   - 063 Grant asylum
   - 064 Grant privilege, diplomatic recognition; de facto relations, etc.
   - 065 Suspend negative sanctions, truce
   - 066 Release and/or return persons or property
7. REWARD
   - 071 Extend economic aid (as gift and/or loan)
   - 072 Extend military assistance
   - 073 Give other assistance
8. AGREE
   - 081 Make substantive agreement
   - 082 Agree to future action or procedure, agree to meet, to negotiate
9. REQUEST
   - 091 Ask for information
   - 092 Ask for policy assistance
   - 093 Ask for material assistance
   - 094 Request action; call for
10. PROPOSE
   - 101 Offer proposal
   - 102 Urge or suggest action or policy
11. REJECT
   - 111 Turn down proposal, reject protest demand, threat, etc.
   - 112 Refuse, oppose, refuse to allow
12. ACCUSE
   - 121 Charge; criticize; blame, disapprove
   - 122 Denounce; denigrate; abuse
13. PROTEST
   - 131 Make complaint (not formal)
   - 132 Make formal complaint or protest
14. DENY
   - 141 Deny an accusation
   - 142 Deny an attributed policy, action, role or position
15. DEMAND
   - 150 Issue order or command, insist, demand compliance, etc.
16. WARN
   - 160 Give warning
17. THREATEN
   - 171 Threat without specific negative sanctions
   - 172 Threat with specific non-military negative sanctions
   - 173 Threat with force specified
   - 174 Ultimatum, threat with negative sanctions and time limit specified
18. DEMONSTRATE
   - 181 Non-military demonstration, walk-out on
   - 182 Armed force mobilization, exercise and/or display
19. REDUCE RELATIONSHIP (as Negative Sanction)
   - 191 Cancel or postpone planned event
   - 192 Reduce routine international activity
   - 193 Reduce or cut off aid or assistance
   - 194 Halt negotiations
   - 195 Break diplomatic relations
20. EXPEL
   - 201 Order personnel out of country
   - 202 Expel organization or group
21. SEIZE
   - 211 Seize position or possessions
   - 212 Detain or arrest person(s)
22. FORCE
   - 221 Non-injury destructive act
   - 222 Non-military injury-destruction
   - 223 Military engagement

Quantitative versus qualitative analysis

The following illustration contrasts the concept of quantitative analysis with the concept of qualitative analysis. The number 10 is a quantitative measure of Bo Derek's beauty. The significance of that measure derives from that imparted by the number system itself. The assignment of the measure 10 only implies that the actress's beauty rates higher than a 5 or a 7. Ten only represents the quintessence of beauty if that number is specified as the top of the rating scale.

A qualitative measure of beauty would be formulated in descriptive terms limited only by the richness and subtlety of the language employed and the sensitivity of the describer. The qualitative measure, thus, could proceed farther towards capturing and refining the essence of beauty than the quantitative measure which only summarizes that essence succinctly.

Both quantitative and qualitative analytical support capabilities are required in information systems that support crisis decision making. As research presented in this thesis has already pointed out, the two measures complement one another. The significance of the quantative measure is that it can quickly flag deviations from the normal to include indication of both the magnitude and direction of those deviations. It must be remembered, however, that

the significance of the deviation indicated is derived from that prescribed by statistical theory alone based on relative values in the number system. A qualitative measure is required to place that deviation in the context of its substantive implications. This process requires detailed analysis of that substance and thorough comparison to other qualitative measures of similar circumstances.

Quantitative analytical support capabilities

Sherwin employs a monitoring mechanism that is activated upon data entry and a statistical package incorporated in the World Event Information Summary (WEISUM) software to provide quantitative analytical support capabilities in his information system. The monitoring mechanism provides three quantitative measures of the level, variety and degree of tension reflected by the international events contained in the current data base. A z-score compares the most recent thirty days' average activity level with preceding levels of activity. An alarm is triggered when the comparison yields a z-score that exceeds the norm by one standard deviation. The variety of tension factor is an uncertainty measure known as "H-rel". This measure addresses deviations in the patterns of activity. It represents an attempt to provide a measure of McClelland's concept of the relations between nations becoming unglued as they proceed towards crisis. Sherwin believes that

regardless of whether these three specific quantitative measures prove to be the most reliable indicators of crises, they do demonstrate that techniques for transforming information about elusive social phenomena into machine readable data and empirical indicators are feasible.

The WEISUM program is used for posing ad hoc research questions concerning the crisis in the form of data matrices. Sherwin offers two examples. First, to analyze the patterns of physical and or verbal hostility between two nations (i.e., measure the increases and decreases in such hostility); the analyst would develop the matrix with periods of time as its row headings and what he defines as physically hostile, verbally hostile, neutral and friendly events as its column headings. These events would be taken from the types of events outlined in Table 1. A second example relative to the analysis of relations between two conflicting parties that Sherwin offers is the construction of a matrix with the nations as actors forming the row headings and the nations as targets forming the column headings. Once the matrix is designed by the analyst concerned, he then uses the graphical and statistical support packages associated with the WEISUM program to assist assessment of the various aspects of the interaction concerned.

Qualitative analytical support capabilities

The software program known as Textual Scan (TEXTSCAN) provides the information system with a qualitative analytical support capability. TEXTSCAN employs keyword searches of the textual summaries included with each record. It also allows the analyst to create subsets from the larger data set that are applicable to the problem of current interest based upon the qualitative data in the system. The use of TEXTSCAN, thus, enhances the capabilities of the monitoring and WEISUM packages by providing a qualitative look at particular issues and concepts. The key-word-in-context query capability also permits expanded retrieval from the data base once the initial data set has been created and examined.

Management support capabilities

Data management in the Sherwin system is accomplished through the use of interactive software known as GENENTRY. This package is adaptable to formats that combine both nominal codes and textual data. It employs validation tables to reject illegal codes and otherwise prevent the entry of illegal data into the system. It also provides system operators with such information as the date of the most recent update, the number of events in the update, and the new size of the overall data set.

The system also includes an Executive Decision Aid

Program to provide a crisis management adaptive learning capability. The aid serves as an institutional memory that allows scanning of historical precedents to reveal options taken, problems encountered, and the successes realized in previous crises. The data base upon which the aid relies currently contains information relevant to some 1100 crises and quasi-crises that have occurred since World War II. The principal crisis selection criteria is that either the United States, the Soviet Union, or the People's Republic of China were involved in the event either as an actor or a target. Beyond information concerning the location, participants and context of each crisis; this interactive file provides the results of historical analyses that indicate what were the problems that generated and perpetuated the crisis, what actions were taken to resolve the crisis, and what were the consequences of these actions. These factors then may be applied to the current crisis for comparison with its parameters and to help place the impact of potential courses of action in their proper perspective.

Fig. 7 provides a flowchart depicting Sherwin's system as it might be employed in an intelligence environment.[24] Defense Intelligence Agency information reports and embassy telegrams are indicated as the primary sources of

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[24] Fig. 7 was taken from Ibid. Fig. 4, p. 65.

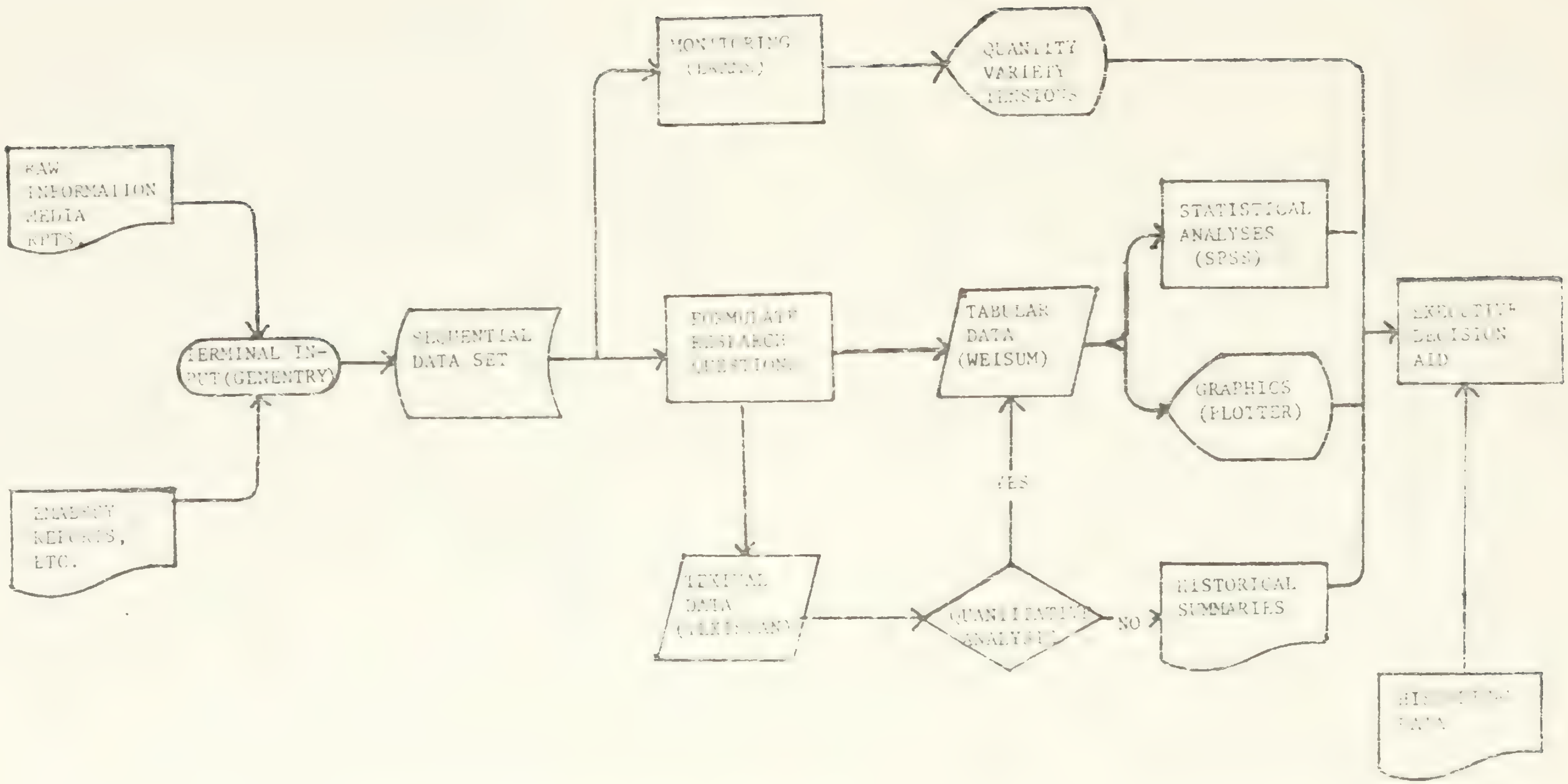

Fig. 7. A Computerized Aid For International Crisis Management

information rather than the news media as employed in his initial project. Several of Sherwin's students in their graduate research have demonstrated the feasibility of adapting these sources to the system. As noted in the flowchart and in the discussion, the system permits functions to occur simultaneously. The monitoring package is continually active. Analytical questions supporting ad hoc research projects may be posed to both the TEXTSCAN and WEISUM packages. Tabular data contained in WEISUM is linked to the Statistical Package for the Social Sciences (SPSS) and to a Versatic Plotter to provide data manipulation and output capabilities. Information from all these programs is then melded with that obtained from the Executive Decision Aid to complete the analytical and decision making support provided by the system.

Prospectus on the Naval Warfare Analysis Experiment

The Naval Warfare Analysis Experiment (NAVWARANALEX) is a research project undertaken by the author in January 1980 to develop an information theory appropriate to both the analysis and management of data on naval warfare activities. Additional automatic data processing support capabilities for the Navy's Ocean Surveillance Information System (OSIS) are being sought through this project.

Chapter I outlined theories and methods obtained from relevant research in the areas of threat detection/perception,

crisis management, systems analysis and management information systems. Chapter II consists of a systems analysis of the naval system with particular emphasis on the intelligence system and the role of the intelligence officer in that system. This analysis serves as a prerequisite to the design of an experimental data base and automated programs to improve the performance of the intelligence system. Chapter III describes the development of the Soviet naval system and its activities, which are monitored, analyzed and reported by OSIS. This chapter provides the flavor of the threat Soviet naval activities pose and indicates the scope of the information requirements applicable to an effective naval warfare data base and its automated analytical support programs. Chapters IV and V describe the naval warfare analytical and management theories, the data base design, and automated capabilities developed in the project. Chapter VI concludes the thesis by outlining a perspective of how NAVWARANALEX results might be applied to OSIS.

II THE INTELLIGENCE SYSTEM AND THE INTELLIGENCE OFFICER

The focus of the thesis is reduced in this chapter from support of decision making at the national level to support of decision making at the naval level of the politico-military system. Its purpose is twofold. First, the chapter provides background for understanding the kinds of problems that confront both the intelligence system and the intelligence officer as he performs within that system. Second, it highlights the areas in which automatic data processing support may be applied to enhance the effectiveness of both the intelligence system and the intelligence officer.

The chapter covers four major topics as follows: (1) Systems of concern to the Naval Warfare Analysis Experiment and their location within the system of international politico-military activities and the national politico-military system. (2) The intelligence system and the intelligence cycle. (3) The role and self image of the intelligence officer. (4) A system's view of naval intelligence problem solving.

Systems of Concern to the Naval Warfare Analysis Experiment

The Naval Warfare Analysis Experiment is involved

primarily with two major systems and their component subsystems. From the system of international politico-military activities, it is concerned with the system of international naval force interaction. From the national politico-military system it is concerned with support of the naval management system.

The System of International Naval Force Interaction

Location and arrangement

Fig. 8 presents a different more detailed view of the international politico-military environment that was first shown in Fig. 6 on page 46.[25] Here the systems and some of the major subsystems that are included in that environment are shown. The system of international naval force interaction represented by set F, is a component of the system of international military force interaction represented by set C, which in turn is a component of the system of international politico-military activities, represented by set A. Since military activities are frequently joint ventures, the system of international naval force interactions intersects with both the system of international ground force interaction (set D) and the system of international air force interaction (set E).

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[25]The analysis of the systems in this chapter is based upon the system's concepts and theories outlined in Chapter I, pp. 29 - 45.

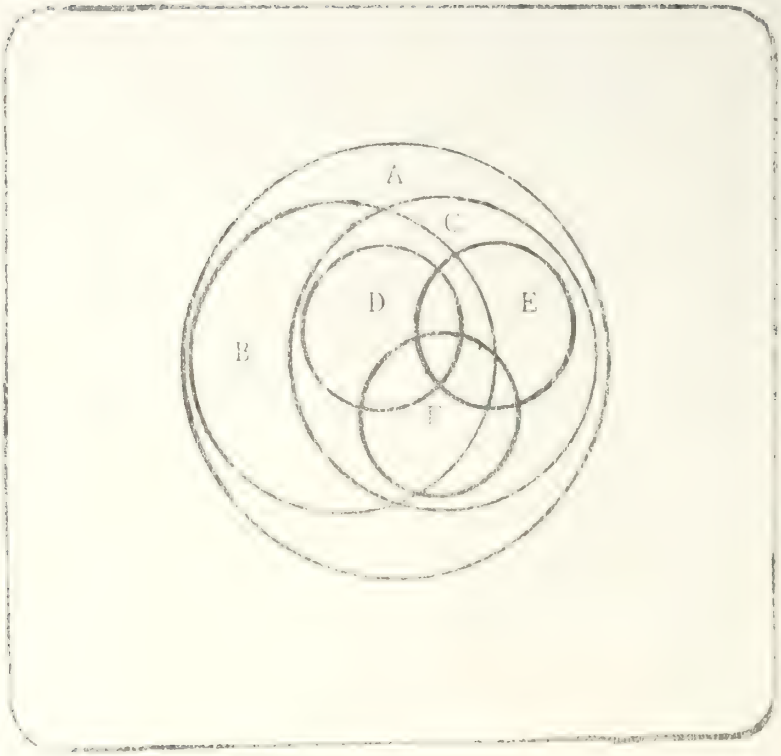

Fig. [illegible]. Systems Within the International Politico-Military Environment

A - System of international politico-military activities

B - System of international political interaction

C - System of international military interaction

D - System of international ground force interaction

E - System of international air force interaction

F - System of international naval force interaction

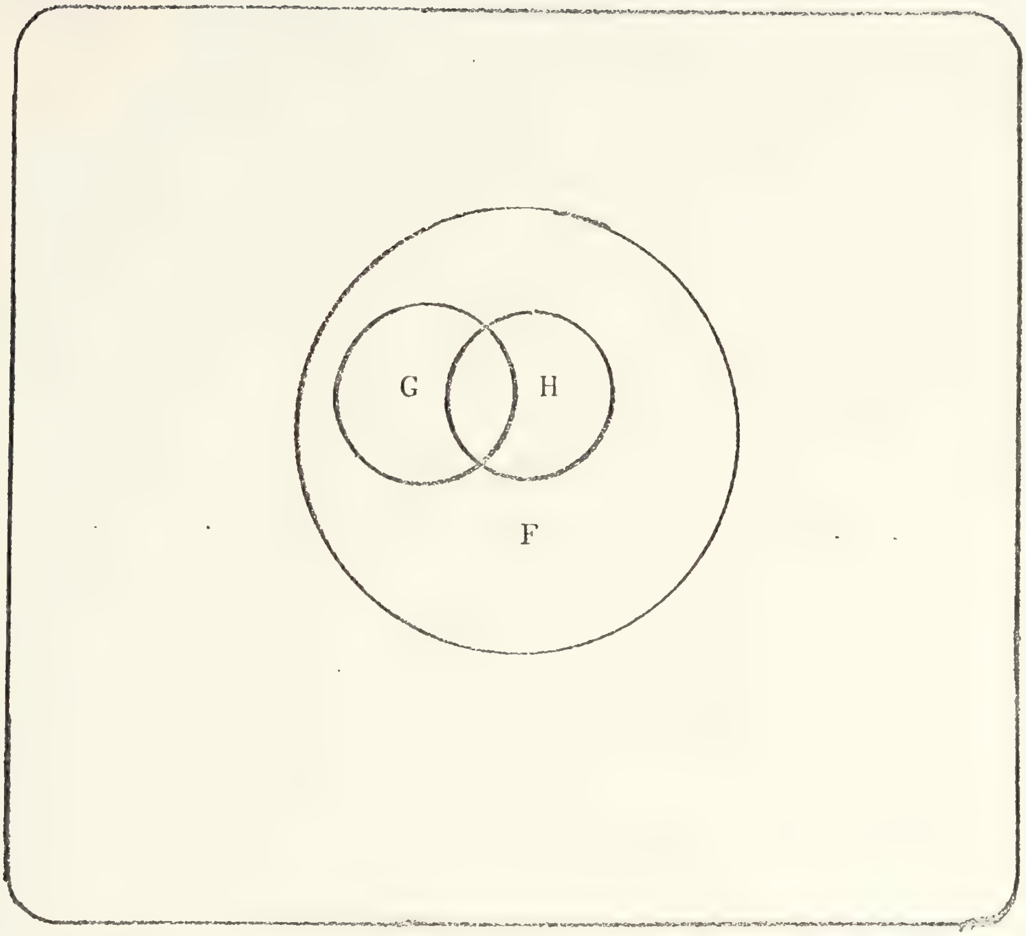

Fig. 9. The International Naval Environment

F - System of international naval force interaction

G - System of Soviet naval force interaction

H - System of United States naval force interaction

The fact that naval forces have air and ground components also contributes to the formation of these intersecting sets. Finally, because military interaction stems from and is directed by political objectives, there is a significant intersection between the system of international political interaction (set B) and the system of international military interaction (set C) including all its components. The intersecting portion of sets B and C can be said to represent operational and representational activities of national military forces in the system of international politico-military activities. This would include wars in addition to normal peacetime operations and joint exercises. The portion of set C that is not intersected by set B can be said to relate to the unilateral activities of national military forces operating in the system of international politico-military activities such as training and resupply.

Fig. 9 depicts the international naval environment in which international naval force interaction occurs. The physical characteristics of this environment would be climatological and oceanographical with the geographical, topographical, and hydrographical characteristics of the coastal areas and near shore also coming into play. The activities of a given nation's naval forces would also be influenced by the politico-military competion between nations and the competition among military forces of that

system as each of these environmental factors contribute significantly to the structure and content of this system.

The systems of interest to the Naval Warfare Analysis Experiment are components of the system of international naval force interaction (set F). These subsystems are the system of Soviet naval force interaction (set G), which is described in detail in Chapter III, and the system of United States naval force interactions (set H). They are represented as intersecting sets to highlight the adversary relationship between these two navies.

The Naval Management System

Location and arrangement

Fig. 10 depicts the United States politico-military environment. The structure and content of this environment have a greater normal impact upon the operation of the politico-military system (set A) than any physical environmental factors. The figure gives a detailed view of the components of a national politico-military system previously shown in Fig. 6 on page 46. Military activities are conducted by the defense system (set B) which has the following three major components: The ground system (set C), the air system (set D), and the naval system (set E). The politico-military management system of primary interest to the Naval Warfare Analysis Experiment is the naval management system (set F).

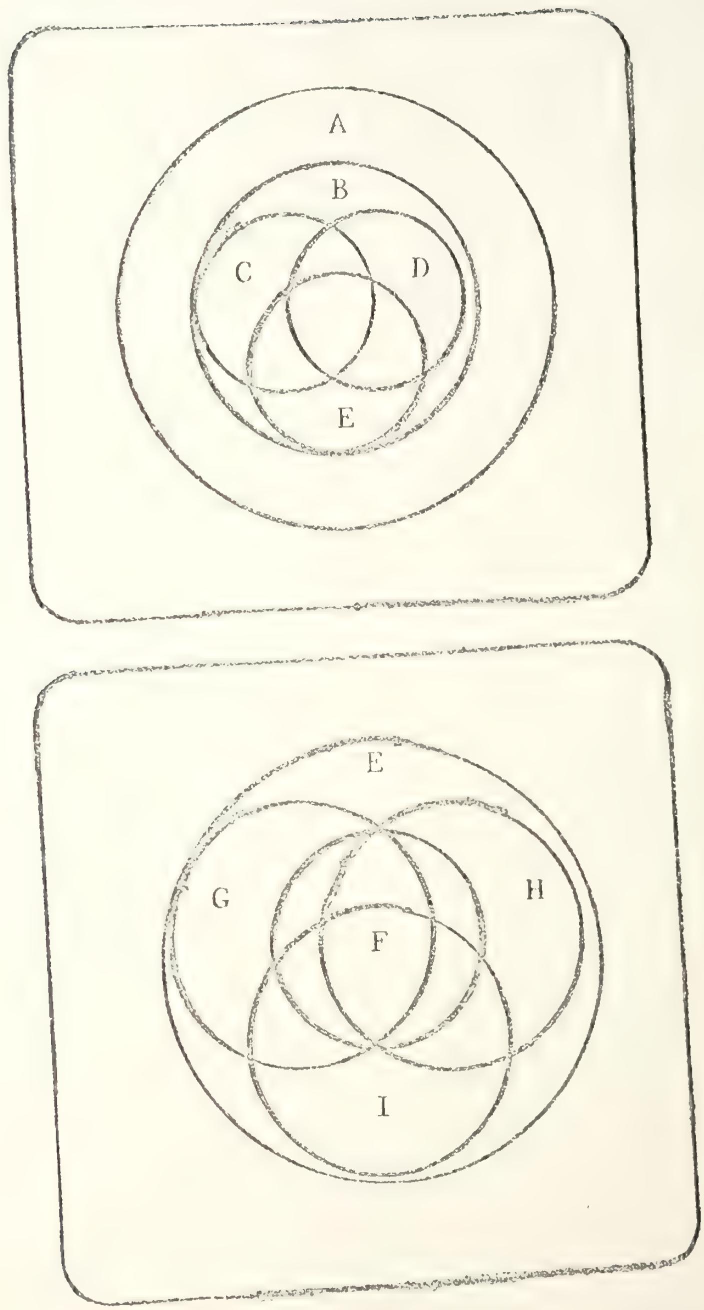

Fig. 10. United States Politico-Military and Naval Environments

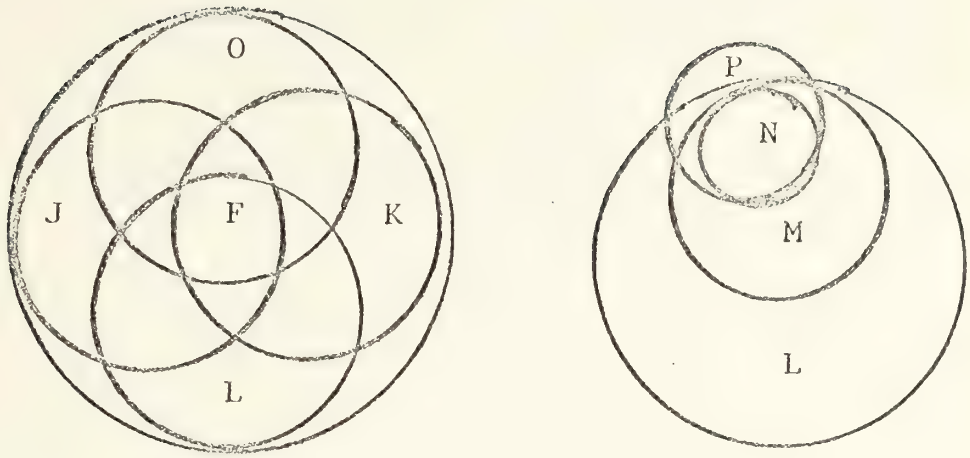

Fig. 11. The Naval Management (F) and Intelligence (M) Systems

<u>Notes on Figs. 10 and 11</u>

Politico - Military Level: A-Political System, B-Defense System, C-Ground System, D-Air System, E-Naval System

Naval Level: E-Naval System, F-Management System, G-Operational System, H-Material System, I-Research and Development System.

Management Level: F-Management System, J-Planning and Programming System, K-Command, Control and Communications (C^3) System, L-Information System.

Ocean Surveillance and OSIS - From L, the Information System: M-Intelligence System and N-Ocean Surveillance Information System. From G, the Operational Systems: P-Ocean Surveillance System.

Fig. 10 also illustrates the complexity of the naval system. The legitimate goals of this system include the development of the doctrine, strategy, tactics, force levels, readiness posture, platforms, weapons, sensors, countermeasures and other capabilities required to meet potential naval threats to the nation's security and interests. These legitimate goals apply to the components of the naval system in varying degrees regardless of whether they are located within the operations (set G), material (set H), or research and development (set I) systems.

Factors in the environment that have the most influence upon naval system activities include the larger defense system, the federal political system, and its constituency. Constraints upon the structure and content of the naval system imposed from the environment result from the competition within the defense system amongst its components for personnel resources and material systems for operations and support. The defense system's personnel and material resources are, in turn, fixed annually by law. This fixed allocation of resources is dependent upon the perception at the national level of government of both potential threats to the nation's security and interests and the relevance of defense missions to national goals and objectives. Definition of goals and objectives relevant to the nation's security and interests results

from considerable interaction both within the federal political system amongst its components and between the federal political system and its constituency.

Functional description

The naval management system (set F) functions at the departmental, material, research and development, and operational/tactical levels of the Naval Establishment. Its purpose is to establish goals and objectives for; compete, acquire and program resources for; and direct and control the activities of the naval system's (set E) major components. These subsystems include the operational system (set G), the material system (set H), and the research and development system (set I). These three components are represented as intersecting sets because the latter two function to support the operational system and its activities. The research and development system is responsible for improving the state of the art with regard to and managing the development of platforms, weapons, sensors, hardware, countermeasures and other capabilities. The material system is concerned with managing the production of these resources and their distribution to the operational system. The operational system is concerned with the maintenance of force levels and readiness posture, tactical development and exercises to test doctrine and strategy, the deployment of forces, and command and

control of naval force operations and activities.

Management system components, as shown in Fig. 11, include: the planning and programming system (set J), the command, control and communications (C^3) system (set K), the information system (set L), and the personnel management system (set O). These four subsystems are represented as intersecting sets because of the mutual support and interaction that is required for performance of the management system's functions. The planning and programming system is involved in the formulation of policy, goals, objectives, doctrine, strategy and programs. It further functions to program and allocate personnel and material resources. These activities correspond to policy formulation functions performed by the decision-making component of the management system shown in Fig. 4 on page 41.

The information system contains components that are responsible for monitoring and generating performance data and indices that identify problem symptoms and presymptoms concerning both the naval system controlled by management and the system of international naval force interaction that is an uncontrolled system located within the naval system's environment. The component of the information system that monitors international naval force interaction is known as the intelligence system (set N). The Ocean Surveillance Information System (OSIS)

(set N) is the primary subsystem of the intelligence system that performs this function with regard to the operational activities of all nations' naval, oceanographic research, merchant, fishing and air fleets on, over and under the oceans of the world.

The command, control and communications system functions to perform the diagnosis and prescriptions phases of the decision cycle shown in Fig. 5 on page 42. These functions correspond to those performed by the problem identification subsystem, the metacontrol subsystem, and correction component of the decision-making subsystem of the management system shown in Fig. 4. The communications component of the C^3 system provides the channels for issuing instructions to and receiving inputs from the controlled naval system. It also provides the channel for inputs to and outputs from the information system.

The personnel management system is primarily concerned with the implementation of personnel programs and the distribution of personnel resources to the components of the naval system. In addition to the resource allocation function; it conducts recruiting, training and educational functions in support of force level, readiness posture, system operation and maintenance, and tactical performance objectives.

The Intelligence System

Functional Description

The functions performed by the intelligence system may be described in terms of a cyclical process whose end result is the production and consumption of information termed the intelligence product. This process is illustrated in Fig. 12. This product is consummed by components located at all levels of the naval system: departmental, material, research and development, operational and tactical. The prime users are participants in the various components of the management system; planning and programming, command and control, training component of the personnel system, and intelligence component of the information system. The purpose of the product is to provide analyses of the capabilities and activities of the naval systems of the world. Capabilities analysis is performed by the technical intelligence components of the system, while activities analysis is performed by the operational intelligence components of the system. The Naval Warfare Analysis Experiment is concerned primarily with the automatic data processing support of operational intelligence analysis and the management of information obtained through the Ocean Surveillance System (set P).

This system is a component of the operational system (set G). The intelligence (set M) component that processes, analyzes and disseminates ocean surveillance

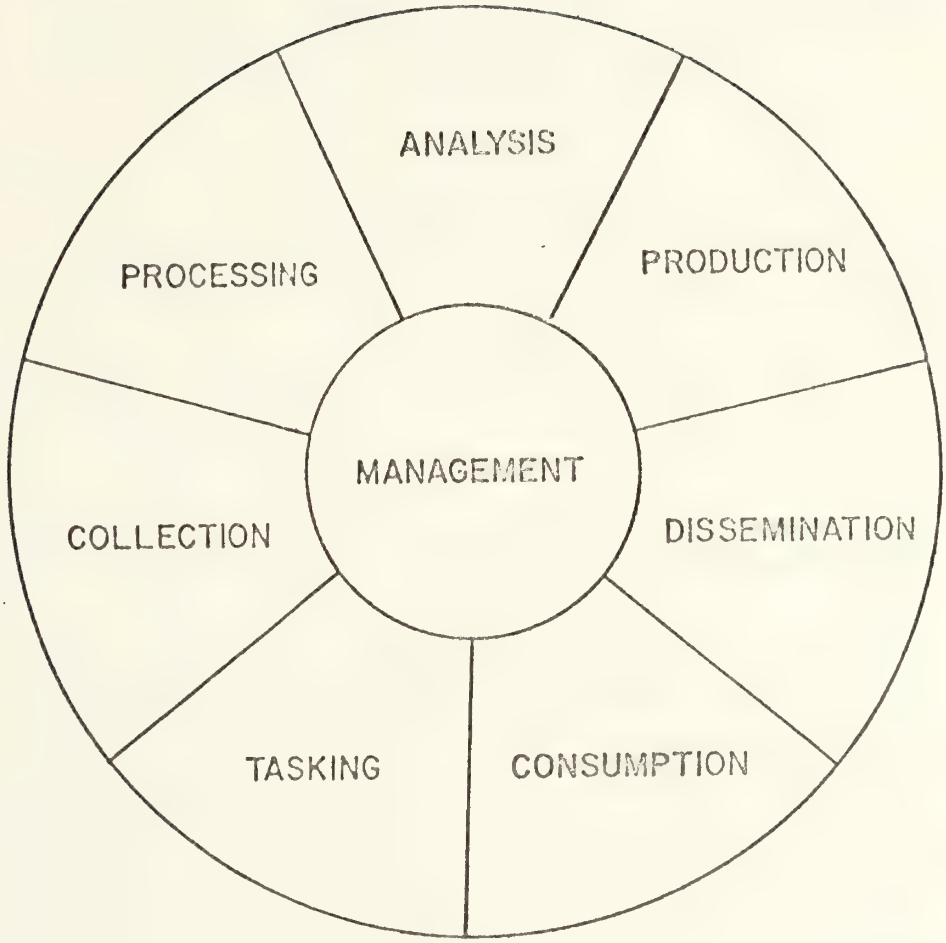

Fig. 12. INTELLIGENCE CYCLE

intelligence is the Ocean Surveillance Information System (set N). Thus, it is located primarily within the intersection of set M with set G (operational/intelligence system intersect). Certain ocean surveillance data also serves as an input to and is passed by OSIS to technical intelligence components of the intelligence system.

<u>Tasking</u>

The goals and objectives of the intelligence system are formulated in terms of intelligence requirements in the tasking or initial phase of the intelligence cycle. These requirements may be articulated as long standing objectives or in the form of specific gaps in the information base that need to be satisfied in a particular time frame. At the defense level, these requirements are institutionalized in the form of Defense Intelligence Agency DIA manuals. These manuals are issued in several volumes and contain collection policy and guidance in addition to the long term objectives themselves.

The process by which requirements are developed is an interactive one. It occurs at all levels of command between the intelligence officer and the commander, operator, planner or other manager that he is assigned to serve. This process is best represented by the development and promulgation of Essential Elements of Information (EEI). In theory, this set of requirements reflects

the knowledge the commander requires about his adversary and the operational environment in order to execute his mission successfully.

Collection

Once the tasking has been formulated through interaction between various command authorities and intelligence agencies, the second phase of the cycle commences. This includes collection and reporting against targets specified by the tasking received. It is conducted by various intelligence resources, sensor systems, and operational forces. Collection results may be disseminated electrically via message, through written narrative reports applicable to specific collection opportunities, or through lengthy cruise and end of mission reports. The written reports also forward sensor and other data for processing and analysis by the technical intelligence components of the intelligence system.

Processing

This phase of the cycle includes the assimilation, organization and management of the incoming data. This must be accomplished in some rational, systematic fashion in order to facilitate analysis of that information. First, the incoming data is differentiated according to established priorities. Some of the data will be time sensitive. Its substance is perishable and it may have to be

disseminated rapidly if its contents are to have an impact on the planning or control of an important operation. The significance of the bits of information that require immediate reaction must be recognized.

This filtering and alerting step is key to the successful performance of any intelligence organization. There is always the danger that the volume of information received from collectors will obliterate the significant bit required by the commander to reach a proper decision concerning the current operation. Thus, the problem of noise raised by Wohlstetter is contended with on a daily basis in the processing phase of the intelligence cycle. The volume of information received by intelligence processing agencies is indeed substantial. Both national and naval collection resources are vast in number and output. Processing resources are limited by comparison. This phase of the cycle requires all the automated assistance it can get to maintain effective performance of the filtering function and thus avoid breakdown of the system.

Analysis

Once incoming data has been filtered, digested and organized; analysis can occur. The purpose of this phase of the cycle is to determine the meaning of each new bit of information by relating it to other bits contained in the data base and to specific intelligence tasking.

Attempts are made in such a manner to reduce the level of uncertainty concerning the adversary capabilities and/or activities being assessed. Additional filtering and alert functions are performed as new insights are gleaned through this process.

Production

The analyst is vitally involved in development of the intelligence product. Preparation of the product must ensure that facts are differentiated from what has been derived or inferred from the facts. It must substantiate the basis of all assumptions made in the analysis. It must detail what remains uncertain. While much of the analytical process may have been subjective in nature due to the measures of uncertainty involved, the presentation of the results in a product must be as objective as possible. To do less would hinder the commander in the successful performance of his functions.

One should be aware of certain pitfalls that may occur during the preparation of the product. The tendency Wohlstetter described as focusing on data confirming expectations of enemy behaviour should be avoided.[26] Current facts should not be arranged to lend support to the claims of previously disseminated analysis. The intelligence problem is a dynamic one. New bits may erase

[26] See pp. 14 - 15 above.

completely the relevance of previous conclusions as they add more certainty to what previously had been unknown or reflect change in the situation. The product can only reflect what was known at the time of its source. The thrust of the analysis should shift as new bits provide a different perspective. Finally, the specific intelligence that pertains to the problem concerned should not be obscured by burying it in the details of the analysis or overshadowing it with the style of the presentation. The significant results should be highlighted for the commander at the beginning of the product and summarized at the end.

Dissemination

The product may be developed as a briefing and disseminated orally using visual aids. Such a setting may provide direct interaction with the particular decision maker and result in immediate feedback concerning his questions and additional requirements. Other results may be transmitted electrically in the form of an intelligence summary message or spot report. Still other results may be written in the form of a study or publication. Standard publications are issued on a regular basis in accordance with an established production schedule and contain updated information produced directly from the various intelligence data bases. If the particilar consumer is linked to the production agency via

computer, dissemination is direct by this channel. For other consumers, these computerized products are produced in batch mode, miniaturized, and then disseminated in microfiche form.

Two basic problems are inherent in the production/dissemination process. The first is the natural lag between the date of the information and the time of receipt by the consumer concerned. This lag may already be substantial in some cases due to the time consummed in the collection, processing and anlytical phases of the cycle.[27] If the producer is an organizational component of the consumming command, additional lag stemming from the production phase of the cycle will be dependent on the number of intelligence resources assigned to that command and their production capabilities. As noted in the discussion above, the intelligence producer may be an independent organization located within the information component of the management system and separated physically from the consumming audience in the operational, material and research and development components of the naval system.[28] In such cases, lag caused by the length of production/dissemination activities is shortened only if

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[27] See the section on time sensitivity and perishable data, pp. 10 - 12.

[28] See pp. [illegible] - 81 and Fig. 11 on p. 74.

dissemination occurs in message form via the communications system or via computer links using these same channels. The lag is lengthened when the intelligence product is disseminated in written form via the mail or courier systems. It is lengenthed even further when reproduction and/or printing of the product is accomplished by a component that is both physically and organizationally separate from the intelligence producer. Thus, the difference between the date of information contained in an intelligence product and the time of receipt and use by the consumer may vary from minutes to months, and in some cases, even years. The total length of the lag relates directly to the complexity of the collection effort; the means of distribution from the collector to the processing agency; and the amount of processing, analysis and production effort required. The lag is lengthened further dependent upon the form of the product and its dissemination means.

The second problem is related to the diversity of the consuming audience spread throughout all levels of the naval system and the variety of their individual intelligence interests and requirements. Like the form of the product, the form of dissemination should be tailored to the particular consumer. The broader and more numerous the consuming audience of a given product is, the more difficult it is for the organizationally independent

intelligence producer to know the particular interests of all the individual consumers that make up that audience. Even when the interests of the audience are known, it is difficult to develop a coherent product that is also tailored to all the various interests concerned. Further, the more numerous the audience, the more complicated and lengthy the dissemination process becomes unless messages or computer links can be employed.

Thus, in many intelligence products what tailoring that can be accomplished must be to what can be established as the general need of the consuming audience concerned. The format developed for the product then becomes more dependent upon the form, content and organization of the data itself. Less and less attention can be paid to reproducing the product in a number of formats that would be particularly useful to individual consumers without lengthening even further the production/dissemination process. The ideal solution would be to have all consumers on-line with the data base and to provide each consumer with the capability for formatting his own reports. Today, not even all intelligence consumers are on-line with the various intelligence data bases, files and computer systems although the intelligence community is pursing that goal.

Consumption

One method that the intelligence system has traditionally employed to deal with the two problems discussed above relates to what the author considers as the last phase of the cycle. Consumption is rarely mentioned in intelligence literature as being part of the intelligence cycle. A considerable portion of particularly the Naval Intelligence Community's personnel resources are devoted to this function, however. That consumption should be considered an integral portion of the cycle stems directly from the concept that intelligence is a means to an end and not the end itself. It is a service providing direct support to command. Supporting the commander's decision making process by assisting it to be conducted on a more rational, knowledgeable bases with regard to information acquired on the adversary, his system, its capabilities and activities is the service that intelligence can provide. The effective use of that information by the operational, material, research and development, and management systems is the ultimate goal.

The intelligence system has assisted components of the other naval systems to complete the consumption function by assigning intelligence resources to key levels of command and integrating them directly with the organizations they serve. These resources then extract information from the multiple intelligence products received by

the particular consuming organization, synthesize the results of this extraction effort and tailor them to the needs of the particular commander, and then inject them into the command planning and decision making process.

Thus, it is in the consumption phase of the cycle that the critical interface between the intelligence system and other naval system components occurs. It is in this phase that the greatest amount of direct interaction with the decision maker occurs. The value of the intelligence product to particular consumers is assessed and feedback to the intelligence system concerning that value and additional intelligence requirements of the individual commanders concerned is provided through this interactive process.

Successful performance of this role requires a particular sensitivity to the commander's needs, both his stated needs already articulated and his real needs represented by understanding of the context of problems with which the commander must contend. As discussed previously, these real needs may be unsolicited ones.[29] The intelligence officer performing such a role must learn to anticipate them. He employs his professional knowledge

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[29]See Churchman on stated and real objectives, p. 32; Ackoff and Holsti on MIS design criteria and framework for analysis, pp. 50 - 55; and the description of Sherwin's design of an information system for crisis management on pp. 55 - 56.

of the kinds of data the intelligence system can provide and marries the results to knowledge of the operational situation and the scope of the particular problem that he gains through interaction with the commander and his staff to complete this anticipatory process.

The amount of interaction with key members of the naval community that performance of this role requres makes such an assignment a highly visible one and a most satisfactory task to fulfill. A danger can arise, however, should the officer performing such a role succumb to the delights of the attention and rewards he receives as a result of his performance. If he focuses on securing the rewards as his primary objective without continuing to concentrate on perfecting the service he provides and acquiring greater understanding of the operational problem concerned, he runs the risk of emphasizing style of performance at the expense of content. Emphasizing only immediate personal satisfaction serves to dilute his perspective. It detracts from the effectiveness of the intelligence system and his own development as a professional intelligence officer.

The results of the consumption phase is an unfolding back into the tasking portion of the cycle. This occurs through the feedback to the intelligence system concerning the value of the product and additional consumer requirements as described above. The cycle becomes

whole with each segment positioned within the framework provided by the organized whole as it functions to contribute to pursuit of system objectives. The position of each segment of the cycle is co-determined by the functional requirements of the intelligence system that must be met in order for it to fulfill its objectives and the specific attributes and properties of components having capabilities that can satisfy these requirements.[30]

Service to Other Naval System Components

Research and development/material systems

The components of the naval system use the intelligence product in a variety of ways to assist pursuit of total system objectives. The research and development system components and the material system components employ the product to gain knowledge of adversary naval capabilities in order to ensure that the platforms, weapons, sensors and other equipment that these systems design, develop and produce can counter the strengths and exploit the weaknesses of adversary material systems. The characteristics of adversary material systems required by these components are the engineering performance parameters derived through technical intelligence analyses. These parameters will reflect the maximum theoretical

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[30]See the definition of a system outline on pp. 29-31.

limits of these systems.

Operational system

The technical intelligence products operational system components use need to emphasize the current capabilities of adversary material systems and how these systems are employed operationally. The characteristics of adversary systems of interest to operational components are the effective performance parameters that have been observed in practice in tactical situations. Effective performance parameters, being less than the theoretical limits indicated by engineering performance measures, provide a better basis for the commander's assessment of the degree of risk to his forces that he might take when deploying them to respond to the threat. Operational components also need to know the current location of adversary forces, pattern of activity, and intentions. For adversary forces to pose a potential threat to U. S. naval forces, their systems have to be capable of detecting the U. S. targets and moving within effective weapons range before the targets can respond to their presence. Then the intention to attack must be made manifest before the actual threat materializes. Finally, operational components use the intelligence product to assist the tactical development process and to plan and conduct training exercises and activities.

Planning and programming system

Technical intelligence data is used by the components of this system to document adversary capabilities that need to be countered and assist justification for U. S. material programs that will accomplish this objective. Operational intelligence products assessing the adversary, his systems and activities are used to assist the development of counter doctrine and strategy. Environmental intelligence is used to assist the planning of U. S. operations and activities. This data would include maps, charts and imagery of the area of operations; descriptions of the meteorological, hydrographical, and oceanographical conditions prevailing in that area during particular seasons; and documentation of the political, economic, social and cultural conditions relevant to the societies and people concerned.

Command, control and communications (C^3) system

These components need to merge both technical and operational intelligence data in order to determine indicators of potential threats to U. S. forces and interests and control the response of the operational system to these threats. Particular requirements include the location, identification, composition and disposition of adversary forces. Knowledge of the communications, sensors and weapons carried by the specific adversary forces

concerned is also required. Patterns of activity and intentions then come into play. The tactics these forces employ, their capability for resupply and logistics support, their military organizational structure, and the identification of adversary personnel and their activities, all are part of the equation.

Personnel management system

The training and education components are the primary users of the intelligence product within this system. The technical intelligence product is employed in training schools to assist personnel to identify and gain knowledge concerning adversary platforms, weapons, sensors and other material systems. The operational intelligence product is used in such tactical training schools as surface warfare, submarine warfare, antisubmarine warfare, electronic warfare, and C^3. Engineering, management, operational, planning and programming, and politico-military curricula are all part of the programs at the Naval Academy, Naval Postgraduate School and War Colleges. All require knowledge of adversary system capabilities and activities to varying degrees. Finally, the intelligence product, the intelligence system, and its capabilities provide the primary topic for the curricula of intelligence training schools, undergraduate and graduate educational programs.

Management of the Intelligence System

Organization and arrangement

The functioning of the intelligence system as a cyclical process has been described above. How well this system's model of a smoothly functioning cycle with each stage unfolding into the next approximates the intelligence system in reality depends upon the effective management of that system. At the macro-level, the reality of the system presents a major complication to its unified management. While from a functional point of view the system may be described as a unified whole; from a structural point of view many of its individual components are separated not only physically, but also organizationally from the principal management component of the intelligence system located within the naval system at the departmental level in Washington, D. C.

The management component responsible for the formulation of intelligence system policies and objectives and for the development and coordination of intelligence programs and activities includes the Director of Naval Intelligence (DNI) and his staff, located within the Office of the Chief of Naval Operations, and the Commander Naval Intelligence Command (COMNAVINTCOM) and his staff. COMNAVINTCOM reports directly to the DNI. NAVINTCOM includes four major field activities. Of these, only the

Naval Investigative Service, whose components are spread world wide, functions outside the Washington D. C. metropolitan area.

The components described above are the only ones that lie strictly within the intelligence system from the structural standpoint. All other components and resources lie within the intersections of the intelligence system with the operational, material and research and development systems.[31] They are subject to the direct control and influence of the respective management components of these systems. The organizational arrangement of the intelligence system in such a manner is necessitated by its primary mission to provide a product as a service to the other components of the naval system.[32]

Several factors assist intelligence departmental management to direct pursuit of system activities in accordance with formulated objectives while maintaining this separate organizational structure. The first is the policy making, resource programming, and activity coordinating charter of the DNI and COMNAVINTCOM. Thus, while the separate intelligence components report via their separate chains of command through the other naval system components, these chains of command end with the Chief of

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[31]See Fig. 11 on p. 74.

[32]See pp. 79 and 89-92.

Naval Operations under whose authority the DNI acts. The second tie is through communications dedicated to the intelligence system. A third major tie is the fact that the principal resources of all intelligence components are allocated under the intelligence program of the Navy budget, which the DNI (assisted by COMNAVINTCOM) is responsible for developing and coordinating. Fourth, the cadre manning the intelligence components in the other naval systems include a core of officer specialists whose assignment and career development is under the direct control of the DNI and COMNAVINTCOM. This core is expanded by a group of officer intelligence subspecialists whose assignments to intelligence billets and training comes under similar influence. It also includes a large group of enlisted intelligence specialists whose assignments and personnel management are under DNI/COMNAVINTCOM control. Finally, all intelligence training, undergraduate and graduate education programs are sponsored by DNI/COMNAVINTCOM.

Objectives and responsibilities

Similar to the functioning of the system on the macro level, the functioning of individual intelligence components at the micro level can be described in terms of the same cyclical process. (The author believes this process to be true regardless of which segments of the intelligence cycle the primary mission of the individual component

emphasizes.) Management of components (and the system) should emphasize two basic concepts to ensure regular and smooth revolution of this cycle.

The first of these concepts is that activities in each succeeding segment of the cycle should be directed on the basis of knowledge and continual awareness of the institutionalized requirements and objectives of the intelligence system established in the tasking phase of that cycle. In this regard, it is particularly important to focus on the commander's essential elements of information.[33] In some cases, what develop as requirements and objectives internally within the component begin to mix with and sometimes overshadow the institutionalized requirements of the system and interests of the consuming audience. There is greater potential for these cases to arise when the intelligence component is physically and organizationally separate from its consuming audience rather than in the cases where the intelligence component is integrated into the consumer's organization. Even then it may occur when the mission of the intelligence component emphasizes the processing, analysis and production portions of the cycle. In such a situation, the analyst has to contend with the tendencies to place the information values he develops internally over the

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[33] See pp. 81 - 82.

institutionalized requirement and to embellish the product with his own views and style in order to gain personal reward.[34] Either tendency lends more support to objectives that are competitive with those of the system and can detract from the relevance of the product.

The second concept relates to management emphasis on intelligence as a service, that its product is a means to an end. This emphasis is diluted wherever effective communication between the intelligence officer and the consumer he serves breaks down or barriers to that communication are established. Either of these may particularly occur in situations where what is commonly referred to as "the green door" syndrome is present. This is a reference to the compartmented nature of intelligence activities and indicates that security barriers are active between intelligence participants and staff participants within the organization to which both are assigned. In these cases, application of the security concept of "need to know" must be taken seriously with regard to the key players in the given operational or technical problem. Without the appropriate application of this concept by intelligence participants to other staff members, the latter may be denied critical information that should be employed in the planning and decision making process. The commander can

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[34]See p. 91.

serve as an effective arbitrator to ensure that this principle is applied appropriately. Organizational barriers can also be established by staff members as well. These barriers either impede communications from intelligence participants or desensitize the receptivity of staff members to that communication.[35]

Institutionalized management activities

Certain aspects of intelligence management have been institutionalized within the system. One such formal arrangement is the issuing of intelligence plans by various levels of command. Such plans can be effective measures to direct the smooth functioning of the intelligence cycle as an integrated whole.

The effective plans follow approximately the same format and provide similar content. First they detail the organizational components within the command and its subordinate commands that are expected to play an intelligence role, as well as the resources assigned to these components which can be employed in that role. They detail mutual intelligence support arrangements and relationships with both senior and lateral commands. They then assess the operational environment noting both its intelligence potential and the constraints to intelligence activities

[35]See examples provided by Allison on p. 11 and Wohlstetter on p. 14.

that it presents.

Next, they summarize the standing intelligence requirements. These are fleshed out later through the detailing in an appropriate annex of the commander's essential elements of information (EEI). The EEI are couched in terms of general questions relating to the adversary's capability to practice and conduct various aspects of naval warfare. Two detailed listings follow each EEI. The first consists of indicators (IND) that provide alerts to when the enemy is practicing a given aspect of naval warfare by documenting the symptoms of that activity. The second list is known as specific orders and requests (SOR). It documents specific requirements, tasking and guidance for the collection and reporting of data when the indicators alert the system to a particular collection opportunity.

Essential to these plans is a concept of operations that details those areas in which it is expected that the management attention of subordinate elements and commands will be focused. The remainder of these plans deal with reporting and data distribution requirements to include the form and priority that reporting is expected to take, how the technical data will be prepared and forwarded for processing, and how feedback related to the results of the collection effort will be obtained from the processing agencies concerned. Desirable feedback concerning the

results of intelligence operations includes the significance of the collection results as they relate to the practice of naval warfare by the target adversary and any new capabilities that the adversary demonstrated, the intelligence requirements that were satisfied or addressed by the particular collection effort, and lessons learned to improve future intelligence operations.[36]

Personnel management

Management of intelligence personnel and career development practices have also been institutionalized by the system. Selection by the intelligence community of its officer specialists is normally accomplished by a screening board designated by and conducted at the departmental level of the system. In the past, officers were not selected for the specialty until they had completed at least their initial naval tour in one of the warfare communities (naval aviation, surface force, or submarine force). Such selection was based on the philosophy that the intelligence community would then continue to receive fresh injections of personnel who shared a common background and experience with the personnel of the warfare

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[36]For an example of an intelligence plan that covers these topics, see Commander, U.S. Second Fleet Intelligence Collection Plan for Fiscal Year 1974, which was developed by the author based upon three years' experience as a participant in the management of operations by the ASW, surveillance, and other major task forces of the U.S. Atlantic Fleet.

communities they were now expected to serve for the rest of their career as intelligence specialists. While many officers up through the rank of lieutenant commander continue to enter the specialty via this same process, now officers can also enter the specialty upon graduation from Officers' Candidate School (OCS). This fact is due to the current number of billet requirements for the assignment of intelligence officers as ensigns to the fleet.

In this first assignment, the young ensigns become exposed to and conduct such intelligence functions as targeting; mission planning; briefing and debriefing; and ocean surveillance collection, processing and analysis. They also become exposed to such naval warfare activities as strike warfare, antisubmarine warfare, amphibious warfare, electronic warfare, and perhaps even some limited exposure to command and control problems. This assignment, thus, provides them with the opportunity to develop common interests and share experiences with counterparts in the warfare communities.

From this fleet assignment, the next billet is in an intelligence activity or on an operational staff. In the former case, primary duties might emphasize functioning in a specific portion of the intelligence cycle. The assignment might be with a technical or operational intelligence activity. Types of operational staff duty include

those at the air wing, task force, or naval force command level. Alternative assignments might be even at the fleet commander-in-chief, unified commander, or departmental staff levels. Functions performed in any of these positions can include standing intelligence watches, developing intelligence plans, conducting capabilities and activities analyses, producing intelligence products, and presenting operational and technical intelligence briefs.

Ideally, postgraduate education at either the Defense Intelligence School or at the masters' level at the Naval Postgraduage School would follow the initial two tours. Officers at this point in their career normally have reached the senior lieutenant or junior lieutenant commander level. The educational experience is designed to provide them with the opportunity to accomplish the following: First, they are presented with material to increase their perspective of the intelligence system, its functions and activities. Second, they study fields, theories, concepts, methodology, techniques and practices from both the academic world and their own intelligence profession and then apply these to intelligence problems. Third, they become exposed to the necessary skills, methods and concepts that will prepare them to assume management roles of increasing responsibility throughout the remainder of their career.

In the assignment after graduation they begin to make

the transition from performing functions at the working level, which they accomplished in their previous tours, to some role in and responsibility for the management of intelligence activities. This may be supervisorial such as a watch team or section head. In prior tours they may have gained supervisorial experience with regard to the management of personnel. In this tour they become more responsible for taking a lead in supervising significant activities of the organization to which they are assigned. As lieutenant commanders, they may even be the head of a large office or department.

In follow on tours as commanders and captains, they progress toward assuming executive management level positions. These assignments are to billets both strictly within intelligence components and with components of the other naval systems. They involve the direction of intelligence operations and activities; policy formulation; the development of systems, resources and programs; and direct interaction with and support of senior naval commanders, program managers, and policy makers.

Education program development

The intelligence masters' program at the Naval Postgraduate School is subjected to regular institutionalized scrutiny by its sponsors, DNI and COMNAVINTCOM. This process takes the form of a curriculum review, which is

performed by a panel consisting of senior members of the naval intelligence community interacting directly with the faculty and staff who deliver and manage the daily activities of the program.[37] The results of the review that are approved by the convening flag officer serve as the policy guidance and tasking for the development of the program and the conduct of its activities until the next session is convened.

The takeoff point for the first review was a task analysis of the intelligence community that had been completed by several members of the first intelligence class under faculty supervision as their masters' thesis research project. The principle conclusion that has been reaffirmed by these reviews is that the educational requirements of the community necessitate the maintenance and continuing development of an interdisciplinary masters' program that focuses on the areas of defense technology, national security affairs, and intelligence analytical and management problems.

The broad education program provided as a result of this conclusion is supported by the following disciplines: mathematics, environmental science, physical science, electrical engineering, political science, economics, history,

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[37]The author participated in the first through the fourth of these reviews while serving as Curricular Officer for the Naval Intelligence Program at the Naval Postgraduate School.

public administration and operations research. The core courses are divided into the three sequences that correspond to the community's areas of interest. These sequences are each interdisciplinary within themselves. The program runs for six quarters (eighteen months). Officers are expected to complete or validate all courses in these sequences (110 quarter hours) in that time frame. They are also expected to complete a master's thesis, which demonstrates the integration of interdisciplinary knowledge and methods acquired from courses in at least two of the three sequences in the program and application of the results to a key intelligence problem. These research projects have been sponsored and supported by agencies within the intelligence community.

The defense technology sequence progresses from building technical vocabulary and qualitative understanding of basic science and engineering concepts to introduction to the general operating principles of technical military systems. Two applications courses examine specific military systems such as weapons, sensors, communications and electronic warfare. The strengths, weaknesses and trade-offs associated with ship, submarine and aircraft platform design are also included in these applications courses. Finally, new technological developments, weapons system acquisition and technological forecasting are pursued through participation in advanced

seminars and practical exercise situations.

The national security affairs sequence describes and analyzes the security objectives and interests of the major powers, assesses their capabilities, and evaluates their intentions and strategies with particular emphasis on the employment of seapower. The sequence synthesizes the political, technological, economic, social and ideological factors that motivate actors in the international system and models varying scenarios of interaction between them. It then relates these factors to the conduct of defense policy in the United States, the perception of specific threats, and the responses to these threats open to the U.S. politico-military system.

The analytical and management sequence provides an introduction to quantitative techniques, substantive research methods, and the primary concepts of resource management. From mathematical preparatory courses, the sequence progresses to methodological surveys of various means to structure given problems, formulate possible solutions, organize and compile the supporting data, assess the reliability of and communicate the significance concerning the results of this effort. These methodological courses include study of both systems and aggregate data analysis. Management problems explored in the sequence include contracting, civilian personnel, planning/programming/budgeting (PPB), program evaluation

and review techniques (PERT), management by objectives (MBO), and organizational development (OD). Also included are the management techniques applicable to automatic data processing systems, their design, basic interface operations, program applications, and associated security problems.

The Intelligence Officer

Self Image

Consumer of science

Essentially, the intelligence officer may regard himself as a pragmatic consumer of science, which he applies to his tasks much in the same manner as the engineer, who relies upon the physical sciences as he confronts given technological problems.[38] Although knowledge of the physical sciences is a principal requirement, they are not the exclusive reservoire of knowledge that the intelligence officer needs. As demonstrated by the education program described above, the knowledge that he requires spans a broad spectrum of disciplines. Further, it is more interdisciplinary in nature, rather than being restricted along particular disciplinary lines.

Because the intelligence officer must assess hardware

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[38] The author first advanced this analogy as a primary theme of a postgraduate thesis produced in June 1966 at the Defense Intelligence School, entitled "Social Changes and Intelligence Requirements", pp. 21 - 22.

and technical systems; he must acquire some knowledge as to the physical principles behind the operation of weapons, sensors, ships, aircraft and submarine platforms. Because he assesses the adversary's military forces, their operations and activities; he should know how these relate to and evolve from the enemy's political, economic, technological, social, cultural and historical systems. Because he also deals with the physical environment; knowledge of geography, topography, meteorology, oceanography, hydrography, transportation and communications networks, and industrial systems comes into play. Because he monitors individual and group behavior; knowledge from the fields of psychology, sociology and anthropology is of assistance.

As an Analyst

The intelligence officer's main constraints with regard to the analytical process are that he must deal with a dynamic situation, respond to these events in near real time, and contend continually with large measures of uncertainty. The demand for his analysis may be felt even before critical factors pertaining to the problem have been detected in the environment and perceived by the system. As events unfold, he finds himself in a speculative situation. This situation requires the formulation of particular hypotheses about the particular events being

assessed. This is an entirely different problem from the academic one for which scientists formulate general hypotheses about general classes of events.[39] Further, the intelligence officer cannot afford the luxury of long contemplation about these events that his academic counterpart enjoys. This is due to his dynamic problem situation and the immediate demand for the results of his analysis in order to assist decision makers to direct system response to the threat posed by the unfolding events.

While the intelligence officer may prefer to and is capable of employing rational scientific models and methods that may apply to the particular problem; intuition and insight will always play a major role in his analytical efforts. Several factors allow him to apply intuition and insight with some skill to the problems with which he must contend. As described previously, he has an intense involvement in the monitoring of adversary activities and the assessing of adversary capabilities throughout his career. He develops continuity over time on these problems as a result of his involvement. Dependent upon both whether his current assignment is as a full time analyst and how close in time he is to the commencement of his analytical tour, he may have continuity in abundance upon

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[39] Klaus Knorr, "The Intelligence Function", Social Science Research and National Security. (Washington, D.C.: Smithsonian Institution, 1963), p. 91.

the particular set of problems involved having monitored them on a daily basis for a considerable length of time.[40]

Based upon the continuity he has accumulated and whatever institutional memory and consciousness concerning the problem that the intelligence system can provide, he begins to discern certain patterns of adversary activities and developments. He also employs the intelligence requirements of which he has internalized knowledge to provide a framework for analysis of the activity he has been examining. In such a manner, he becomes sensitized to deviations from the norm and employs this perception to measure the contribution of each new bit of information received to the picture that he is seeking to construct.

By assessing both those portions of the picture that he has managed to complete and the dimensions of the uncertainty that remains, he prepares to offer his commander his best judgment concerning what has been detected and perceived up to that point in time. He also must be prepared to shift his analysis in a new direction should new bits of information offer contradictory evidence.[41]

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[40] See discussion on career development pp. 103 - 106, and educational program pp. 106 - 110.

[41] See Ackoff's discussions of symptoms and presymptoms on pp. 40 - 45, Holsti's framework for analysis pp. 50- 51, on information systems pp. 54 - 55, Sherwin's design criteria and analytical framework pp. 55 - 57, and on EEI, p. 102.

Interacting with his commander, organization planners, operators, technicians and other key personnel; the intelligence officer next determines how his product has satisfied the critical requirements of the problem. Then he redirects his focus toward gaps identified in the information base through this process. Thus, the cycle unfolds unto its beginning. He continues attempts to resolve the remaining uncertainties and contend with new problem ramifications that have been revealed.

<u>As a manager</u>

How well the individual intelligence officer performs as a manager within the intelligence system is dependent upon the management experience and education he receives as he progresses through his career. Acquisition of management skills is a critical career development problem. It is complicated by the fact that early on in an individual's career, the intelligence officer must primarily perform working level functions and has less opportunity than counterparts in the operational and material components of the naval system to develop management skills.

A young ensign on board a major combatant or submarine may become a division officer fairly early in his career. As such, he is charged with organizing and coordinating the activities of the division's personnel,

operating and maintaining the division's systems, and concerning himself with the development and support of his people. From division officer he progresses to department head responsibilities. The young supply officer or civil engineering officer also assumes significant management functions early in his career for such activities as disbursing, stores, commissaries, public works and construction. All these have similar attendant personnel and resource management responsibilities.

The young intelligence officer at the same stage in his career must spend the majority of his time developing his own professional skills, producing the intelligence product, and acquiring knowledge of both adversary capabilities and activities. There are very few assignments in which the intelligence officer would even have the opportunity to gain management skills. In some intelligence centers, he might be able to work up to the division officer level. In a collection activity; he might be able to gain some program, system and resource management experience, or at the minimum be a direct observer of the process. Further, because he is so immersed in intelligence professional development efforts and his time is consummed by the demands of working level activities; he may have little left to begin to gain an understanding of and perspective on the intelligence system as a whole or an appreciation for the variety of resources and capabilities

that the system provides.

As pointed out earlier, intelligence training and education experiences obtained by the mid-career point assist the transition from intelligence analyst/producer to intelligence manager. There is always the danger that the transition will never be made or made only with little success. In some cases, the individual becomes too comfortable with the analyst/producer role and the rewards that it can bring. Thus, he does not seek assignments that will give him the opportunity to acquire and perfect management skills soon enough. Thus, when he passes the mid-career point and is assigned to billets that require him to perform in the management role, he is not ready to provide such performance. Further, even if such an individual is a brilliant performer in the analyst role, the benefits he provides a given command may cease when he is transferred. The investment he has made in such a case has been in his own performance alone. When he departs, the capability left the command is degraded until his relief can build similar continuity on the problem and acquire similar analytical skills.

In other cases, the system is the cause for the lack of managerial performance on the part of individuals later in their career. This is because the management components in the intelligence organizations to which these individuals were assigned during the early, and even middle

portions of their careers, did not give them sufficient opportunity to first observe and then gradually become participants in the management process.

Management Precepts

There are some precepts that intelligence management can follow that both provide examples to and assist the development of subordinate personnel assigned to the organization.

Organizational management

With regard to the organization of an intelligence component or activity, this should be accomplished along mission and functional lines. It is helpful to have the division of labor and resource allocation to the various components of the activity spelled out in writing. Functional responsibilities assigned to the component should be related to accomplishment of the activity's mission. It should be demonstrated how components interrelate and complement one another to pursue established activity objectives. These relationships should be reinforced during indoctrination and training sessions.

Personnel management

With regard to personnel management actions, subordinates should be encouraged to display initiative, assume responsiblities and perform functions beyond

that normally expected of their current grade or rank. Effort on the part of subordinates to achieve and sustain such performance should be rewarded on a regular, continuing bases. The manager should convey to his subordinates that they will receive the credit when things go right and that he will absorb the heat when things go wrong. Further, the manager should convey to his subordinates that should their initiatives not be productive in the short run, he will give them the opportunity to make their effort productive and provide them with the proper guidance to achieve that end.

Resource management

Finally, with regard to resource management, subordinates should be encouraged to seek continually ways to extend the performance of their systems beyond current expectations. They should also be encouraged to formulate recommendations and document requirements for improvements to these systems and for new systems to increase the efficiency of mission performance. The results of these efforts then should be taken by management and forwarded up the chain of command for approval, programming and eventual implementation.

Results

Managers who follow these precepts will discover that contributions and benefits provided the command will

not cease when individual subordinates are transferred. Their contributions will endure and provide continuing benefit to the command beyond their presence. Because the professional development of these personnel has been encouraged in this manner, they will have made substantial investments in the activity beyond that investment they made in their individual performance. As a result, the activity's systems will be performing beyond expectation. Its resources will provide a productive yield. More efficient methods of operations will have been discovered. Finally, the requirements for new systems and resources will have been requested and supported with detailed documentation ensuring even greater productivity for the activity in the future.

Academic Models to Assist the Intelligence Problem Solving Process

Role Models from Science

Comparison of scientists

Table 2 compares role models that represent idealized categories of scientists.[42] It compares these categories of scientists in terms of their world view of the status of science as a specific field of knowledge in relation to other fields; their beliefs as to the nature of scientific

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[42]This table was constructed based on a composite of individual tables found in Ian I. Mitroff and Ralph H. Kilmann, Methodological Approaches to Social Science, (San Francisco: Jossey-Bass, Inc., 1978), pp. 34, 56, 76 and 95.

TABLE 2

COMPARISON OF SCIENTIFIC APPROACHES

[illegible] CATEGORIES		ATTRIBUTED CHARACTERISTICS			
		ANALYTICAL SCIENTIST	CONCEPTUAL THEORIST	CONCEPTUAL HUMANIST	PARTICULAR HUMANIST
External relations	Status of science as a special field of knowledge in relation to other fields.	A. Occupies a privileged and a preferred position; value free, apolitical, cumulative, progressive, disinterested. Clearly separable from other fields, clear lines of demarcation, autonomous, independent, strict hierarchical ordering of scientific fields from precise to less precise fields.	A. Occupies a privileged and preferred position, but is not clearly separable from other fields; no clear lines of demarcation; not autonomous or independent, no strict hierarchical ordering of fields; all depend upon one another; science is, however, value free and apolitical.	A. Does not occupy a privileged and preferred position, is not clearly separable from other fields; no clear lines of demarcation; not autonomous and independent; all fields of knowledge depend upon one another. Science is not value free; it is political.	A. Does not occupy a privileged and special position; may be subordinate to poetry, literature, art, music, and mysticism as older, "superior" ways of knowing.
Internal properties	Nature of Scientific knowledge.	B. Impersonal, value free, disinterested, precise, reliable, accurate, valid, reductionistic, causal, apolitical, cumulative, progressive. Clear standards for judgment, realistic, antimystical, unambiguous, exact.	B. Impersonal, value free, disinterested, holistic, valid, apolitical, imaginative, multiple-causation, purposeful ambiguity, uncertainty, problematic.	B. Personal, value-constituted, interested activity; holistic; political; imaginative; multiple causation; uncertain; problematic; concerned with humanity.	B. Personal, value constituted, interested, partisan activity; poetic, political, action oriented; acausal, nonrational.
	Guarantors of scientific knowledge	C. Consensus, agreement, reliability, external validity, rigor, controlled nature of inquiry, maintenance of distance between scientist and objects studied.	C. Conflict between antithetical imaginative theories, comprehensive holistic theories, ever expanding research programs.	C. Human conflict between knowing agent (I) and subject known (S); inquiry fosters human growth and development.	C. Intense personal knowledge and experience.

TABLE 2

(Continued)

[illegible]TIVE CATEGORIES		ATTRIBUTED CHARACTERISTICS: ANALYTICAL SCIENTIST	CONCEPTUAL THEORIST	CONCEPTUAL HUMANIST	PARTICULAR HUMANIST
[illegible]ternal [illegible]pects (continued)	Ultimate aim of science.	D. Precise, unambiguous theoretical and empirical knowledge for their own (disinterested) sake.	D. To construct the broadest possible conceptual schemas; multiple production of conflicting schemas.	D. To promote human development on the widest possible scale.	D. To help this person to know himself or herself uniquely and to achieve his or her own self-determination.
	Preferred logic.	E. Aristotelian, strict classical logic, nondialectical and determinate.	E. Dialectical logics, Indeterminate logics.	F. Dialectical behavioral logics.	D. The "logic" of the unique and singular.
	Preferred sociological norms (ideology).	F. Classical norms of science: Communism, Universalism, Disinterestedness, and Organized Skepticism (CUDOS).	F. Norms are a function of one's theoretical perspective and cannot be separated from one's conceptual-theoretical interests.	F. Economic plenty, aesthetic beauty, human welfare.	F. Counternorms to CUDOS: Particularism, Solitariness, Interestedness, and Organized Dogmatism.
	Preferred mode of inquiry.	G. Controlled inquiry as embodied in the classic concept of the experiment.	G. Conceptual inquiry; treatment of innovative concepts from multiple perspectives; invention of new schemas.	G. Conceptual inquiry; treatment of innovative concepts; maximal cooperation between E and S so that both may better know themselves and one another.	G. The case study; the in-depth, detailed study of a particular individual.
	Properties of the scientist	H. Disinterested, unbiased, impersonal, precise, expert, specialist, skeptical, exact, methodical.	H. Disinterested, unbiased, impersonal, imaginative, speculative, generalist, holistic.	H. Interested; free to admit and know his biases; highly personal, imaginative, speculative, holistic.	H. Interested, "all-too-human" biased, poetic, committed to the postulates of an action-oriented science.

knowledge; their postulation of the guarantors of scientific knowledge; their stated ultimate aim of science; their preferred systems of logic, sociological norms, and mode of inquiry; and the individual attributes or characteristics of each type of scientist. The approaches to research and problem solving represented by the four scientific types compared in the table form a continuum with that of the Analytical Scientist on one end and that of the Particular Humanist on the other.

While examination of these types reveals such a continuum, they are idealized forms. Except in rare instances, no one individual (much less a particular group of individuals) could be expected to fit precisely into one of these molds. Rather a composite is much more likely whether applied to individuals or groups. The exact composition of an integration of these role models that could be applied would vary from individual to individual and from group to group. What could be applied from each category would depend upon the personal predilections of the individual concerned, the requirements of the role that he performs, and the values and norms of the group in which he participates.

Application to the intelligence officer

As noted previously, the intelligence officer is aware and is capable of employing the methods of the

Analytical Scientist.[43] He too strives for precision, accuracy, and reliability in his anlytical efforts and in the predictions he makes. The contsraints of his problem, however, force him to deal with large measures of uncertainty. Like the Conceptual Theorist, he recognizes the value of uncertainty and is able to respond to the challenge of assessing and incorporating its dimensions into the problem solving process. Further, the intelligence officer is comfortable with employing dialectical logic to develop contrasting theories and apply them in an innovative fashion to the phenomena that he has detected and perceived. He cannot afford, however, to end his effort with the development of the contrasting theory and to value the theories for their own "interestingness sake", which is the predilection of the Conceptual Theorist. He must go beyond that point and use the theories he has developed to construct a particular hypothesis that will explain the event in question.

Thus, he shares the view of the Conceptual Humanist that science's value is not in the performance of the process, that it is not an end in itself, but that it is both policital in nature and is a service to be used to accomplish the goals of humanity. There must be an action phase to the process if the answer provided by use of the

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[43]See pp. 111 - 114.

scientific method is to bear fruit and serve mankind. In the case of the intelligence officer, his bias is a fervent belief that his product is useful to his commander, that his service contributes to defending the nation's security and interests, and that this provides the greatest good to the greatest number by keeping his society free from subjugation by another and allowing it to pursue its independent development. Again, like the Conceptual Humanist, the intelligence officer recognizes the value of knowledge that can be obtained through the application and integration of multiple disciplines and seeks to become adept at this process. Any Particular Humanist influence upon the individual intelligence officer will intensify his action oriented approach and personal fervor as he interacts with others within his own subsystem and the management system he serves to both contribute to and learn from the joint development of solutions to given, immediate, particular problems. Particular Humanist characteristics can also add to the creativity of his effort and capacity for self-expression.

The need for an intergration of these approaches becomes apparent when considering the role of an intelligence officer as a manager. The resulting model would approximate a systems approach to problem solving. The manager needs a holistic, systems approach if he is to be successful in formulating activity policies that are

consistent with and contribute to accomplishment of the objectives of the parent system. Such an approach aids in the establishment of objectives for components of the activity that not only encourage efforts on the part of each component that are mutually supportive and contribute to mission accomplishment, but also are realistic and within the capabilities of the respective components. Finally, managers employing such an approach are conscious of the need for and know how to establish an effective feedback loop that not only will convey to them the progress the activity is making toward mission accomplishment, but also the impact of both activity and component management decision making upon that effort and the contributions of these decisions to that progress. In such a manner, problems are identified, responses can be formulated, and subsequent effort can be controlled and adjusted to the course that will yield the proper solution.

A Systems View of Problem Solving

Mitroff and Kilmann developed the model shown in Fig. 13 to illustrate the systems view of problem solving.[44] Each inquiry normally starts with the identification and recognition of the reality situation applicable to the problem concerned. While this is the

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[44]Mitroff, Methodological Approaches, p. 117. Discussion of the model occurs on pp. 116 - 121 of his book.

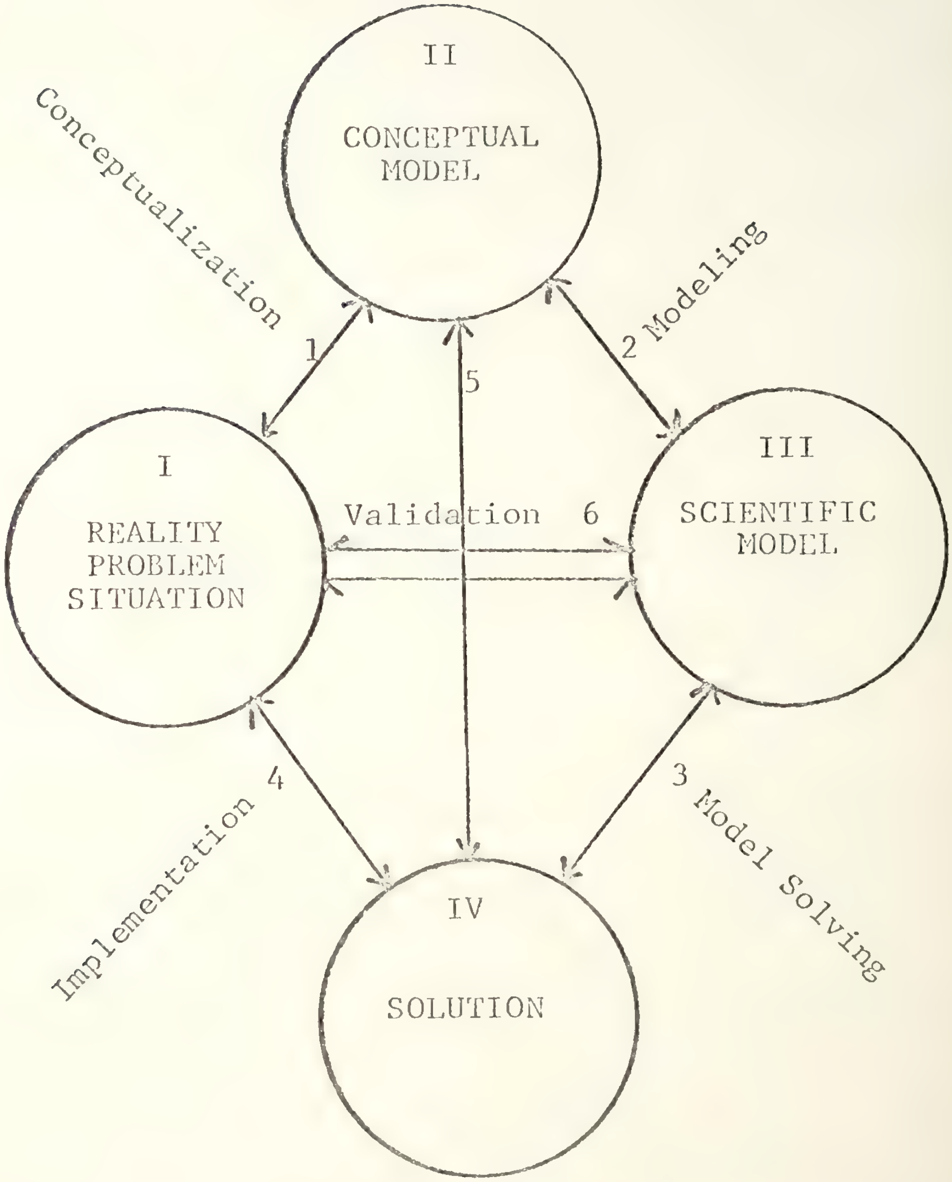

Fig. 13. A Systems View of Problem Solving

logical starting point, it may also be the ending or the middle. This is because from a systems viewpoint, where one starts and ends an inquiry results in the complicated four-way interaction effect that is described by the model. Proposed solutions can lead to a new perspective of the reality situation. Initial conceptual and scientific models may be revealed to differ from the reality they seek to depict or suggest that the original perception of the reality situation was inaccurate. The solution that evolves and is finally implemented might diverge from the models in order to become relevant to the reality situation. The evolution of the solution might also suggest corrections to the models that yield a new perspective of the problem.

The conceptual model requires formulating the macro perspective of the problem. Its formuation consists of a selection process that chooses a particular world view of the problem and establishes commitment to that world view as the framework for the plan of action that will lead to the proposed solution. The scientific model corresponds to the micro perspective of the problem. It selects from the particular theories and methodologies suggested by the conceptual model and constructs testable hypotheses that will yield exact, detailed proposals for the problem's solution. The solution has to be fed into the reality situation in order to complete the process. This effort

constitutes the action oriented implementation phase described in the model. The line in the model that represents the interaction between the reality situation and the scientific modeling process suggests the degree of correspondence that must be maintained between the scientific model and the reality. The line between the conceptual modeling process and the solution corresponds to the degree to which both the solution follows from the particular conceptual model and the solution affects changes in that model.

The remainder of the thesis applies this problem solving process to the problem of concern to the Naval Warfare Analysis Experiment. Chapter III describes the reality situation of concern. Chapter IV develops naval warfare analytical and information management theory as the conceptual model. Chapter V then details the scientific model by describing how the Naval Warfare Analysis Experimental Files were programmed and employed to provide solutions to intelligence analytical and managerial problems. Chapter VI then outlines the concept of operations that may be implemented to provide capabilities suggested by the results obtained through the Naval Warfare Analysis Experiment to the Ocean Surveillance Information System.

III. THE REALITY SITUATION: EVOLUTION OF THE SOVIET UNION SINCE WORLD WAR II AS A DOMINANT MARITIME POWER

Fleet Admiral Gorshkov

Up until the recent years, the Soviet Union has been thought of in the West as predominantly a land power given that nation's straddle across the expanses of the Eurasian land mass. As might be expected, Admiral of the Fleet of the Soviet Union Sergey Georgiyevich Gorshkov takes particular umbrage at the implications of this concept. Commenting in his book _Seapower of the State_, Gorshkov states:

> 'Comparatively recently, specifically on 4 August 1970, then President of the United States Richard Nixon made the statement: 'What the Soviet Union needs in the way of military preparations is different from what we require. The USSR is a land power, and we primarily are a naval power; therefore our needs are different.' Need it be said that Nixon's statement, which is a modern version of earlier attempts by British politicians and officials of the British Admiralty to prove the absence of any need for Russia to have a powerful navy, has no connection with the real state of affairs and contradicts the history of the development of our Navy in the past and is at variance with the interests of our country today."[45]

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[45] Washington Post of [illegible] August 1970 as quoted in Fleet Admiral Sergey Gorshkov, _The Seapower of the State_, Moscow: Military Publishing House, 1976), p. 87.

How this impression has come to be corrected in Western eyes and particularly the views of Gorshkov, the architect of the evolution of Soviet seapower, are the subjects of this chapter. Starting with the works attributed to Gorshkov that are available in the West, the chapter first focuses attention on the concepts of Navy building and employment by the state that are documented in particular in Seapower of the State. Then it turns to the results of the Soviet Navy building effort and the tremendous expansion in Soviet naval activities that is the reality of the 1980s. It is the exercise of Soviet naval capabilities through these increasing global activities that is the principal subject of naval warfare analysis by the U.S. intelligence community today.

His Credentials

Who is Admiral Gorshkov? What are his credentials? How have his views reached the West and what were his purposes in giving them expression? Admiral Sergey G. Gorshkov was ordered to Moscow in mid-1965 as Deputy Commander-in-Chief of the Soviet Navy. On 1 January 1956, he formally assumed the top positions of Commander-in-Chief and Deputy Minister of Defense at the age of 45.[46] He has exercised the authority and responsibilities of

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[46] Norman Polmar, Soviet Naval Power: Challenge for the 1970s, revised, (New York: Crane, Russak & Company, 1974), p. 32.

these top positions, which may be compared to a combination of the U.S. Chief of Naval Operations and Secretary of the Navy, ever since. No other naval leader in the world since World War II possesses such experience and continuity at the helm.

He has published one or more articles in a Soviet military journal every year since at least 1963. (See Table 3 for a sample listing that may not be exhaustive due to the probable unavailability of other writings to Western sources.)[47] A major significant work that captured the attention of Western readers was "Navies in War and Peace". This included some 11 articles published in the Soviet Naval Digest (Morskoy Sbornik) during 1972 and 1973. This is the primary journal for Soviet naval personnel. Given such a readership, the primary purpose of Gorshkov's articles above has been assessed as that of "developing a unified viewpoint among Soviet naval officers."[48] One reviewer has judged Gorshkov's writings as having three major objectives. These are justifying the importance of a navy to a great power; enlisting and praising the Party's support of the Navy; and clarifying

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[47] William H. Thompson, "Sea Power at the State--An Internal Debate?" in Paul J. Murphy, ed., Naval Power in Soviet Policy from the series Studies in Communist Affairs, Vol. 2, (Washington, D.C.: United States Air Force, 1978), p. 22.

[48] Rear Admiral Donald P. Harvey, A Review of Seapower of the State (Washington, D.C.: Office of Naval Intelligence 1977), p. 1

TABLE 3

ARTICLES AND BOOKS BY S. G. GORSHKOV

1. "Faithful Defender of Our Sea Frontier," *Agitator*, July 1958.
2. "Concern of the Party for the Navy," *Morskoy Sbornik*, July 1963.
3. "The Navy of Our Homeland," *Kommunist Vooruzhennykh Sil*, July (Vol. 13), 1963.
4. "Soviet Sailors in the Battle for the Liberation of the Danube States," *Morskoy Sbornik*, August 1964.
5. "The Soviet Navy in the Great Patriotic War," *Voyennaya Mysl'*, May 1965.
6. "Honorable Awards of the Homeland," *Morskoy Sbornik*, June 1965.
7. "The 23rd Congress of the CPSU and the Tasks of Navymen," *Morskoy Sbornik*, May 1966.
8. "The Urgent Tasks of the Naval Rear Service," *Tyl i Snabzheniye*, July 1966.
9. "The Development of Naval Art," *Morskoy Sbornik*, February 1967.
10. "Guarding the Conquests of the Great October Revolution," *Morskoy Sbornik*, October 1967.
11. "The Navy of the Socialist State," *Voyennaya Mysl'*, January 1968.
12. "The Navy in the Great Patriotic War," *Morskoy Sbornik*, May 1970.
13. "Navies in War and Peace," *Morskoy Sbornik*, February-June 1972; August 1972-January 1973.
14. "The Black Sea Fleet in the Battle of the Caucasus," *Voyenno-Istoricheskiy Zhurnal*, March 1974.
15. "Certain Questions Concerning the Development of the Naval Art," *Morskoy Sbornik*, December 1974.
16. "Navy Did Its Duty for the Homeland Right to the End," *Morskoy Sbornik*, May 1975.
17. "Historical Experience and Present Day," *Problemy Filosofii*, May 1975.
18. "Oceanic Shield of the Homeland," *Kommunist Vooruzhennykh Sil*, April (Vol. 7), 1975.
19. "Greeting the 25th Congress of the CPSU," *Morskoy Sbornik*, February 1976.
20. "A Most Important Factor of the Navy's Combat Readiness and Combat Efficiency," *Tyl i Snabzheniye*, July 1976.
21. *Morskaya moshch' gosudarstva (Sea Power of the State)*, Moscow: Voyenizdat, 1976.

naval theory to Soviet navymen and others.[49]

Seapower was published by the Moscow Military Publishing House in 1976 and seems intended for a much wider readership. Its distribution of 60,000 copies has been termed an abnormally large run for a military work. A review of Seapower published under the auspices of the U.S. Director of Naval Intelligence states:

> "The size of the printing clearly indicates that the book was aimed beyond the standard circle of military readers toward an all-union-wide readership of members of the Soviet Communist Party, of the Soviet military-industrial establishment, and of other opinion makers in the Soviet Union. Gorshkov is, in effect, explaining to them exactly what they are getting for their huge investment in the maritime area."[50]

His Concept of Seapower

Gorshkov places the concept of seapower in the context of Marxism:[51]

> "Marxism considers the geographical medium, of which the World Ocean is a most important element, to be among the many factors influencing the development of human society. It occupies almost three-fourths of the surface of our planet and possesses colossal biological, energy and mineral resources."

He then relates the world ocean to a definition of seapower and the interests of the state:

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[49] John G. Hibbits "Admiral Gorshkov's Writings: Twenty Years of Naval Thoughts" in Naval Power in Soviet Policy, p. 1.

[50] Gorshkov, Review, p. 1.

[51] Gorshkov's development of the concepts of seapower described below was taken from Seapower, p. 1.

> "There is a basis for regarding the totality of the means for mastering the World Ocean and the means for defending the interests of the State, which determines the capability of one country or another to utilize the military-economic resources of the ocean for its own purposes."

That he views the concept of seapower is that of a system is demonstrated by:

> "The seapower of the State is rightly regarded as a system which is characterized not only by the relationships between its components (Naval, transport, fishing, scientific-research fleets, and so forth), but also by an indivisible unity with the environmnet, the ocean, in an inter-relationship through which the system expresses its own unity."

Finally, with regards to the significance of the components, there is no doubt as to his emphasis as he places them in historical perspective.

> "The importance of the individual components comprising seapower is not constant. It is determined by specific historical conditions, however, the dominating importance of the Navy always remains."

His View of Naval History

When discussing the role of the Navy vis-a-vis the other armed forces, Gorshkov continues to draw upon the historical perspective. He quotes Peter I as stating graphically:

> "Every ruler who has only a land army has only one hand, while he who has a fleet has both hands."[52]

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[52] Naval Regulations (Morskoy Ustav), St. Petersberg, 1721, p. 2. as quoted in Ibid., p. v.

He sees an interrelationship of factors as determining the proper role and composition of the army and navy at any given historical stage:

> "The importance of an army and navy, at a given level of development of technology and economic resources, has always been determined by the emerging politico-strategic situation and by the relative position of states or the nature of the coalition. In some stages of history, the primary role has been played by ground fources, and, in others, by navies. The position and role of each of the branches of the armed forces can vary in peacetime and wartime, depending on technical changes, the enemy, the geographical conditions and so forth. The experience of history attests to the fact that each branch of the armed forces makes its own individual and always weighty contribution to the victory. There have been almost no purely land or purely naval wars."53

The World Wars

He notes that in the wars waged by Czarist rulers when they failed to appreciate fully these concepts and gave inadequate attention to naval development so that the Navy was not maintained in accordance with the requirements of the historical stage, either military defeats were the result or failure of peacetime policies to attain specific goals and objectives was demonstrated. He cites in particular the failure of the Czar and his administration to learn from the experience of the Russo-Japanese War as to the decisiveness of naval engagements and modern naval technology. Thus, the Russian Navy

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53 Ibid., p. v.

remained quite ineffectual due to the lack of the Czar's concern. When the test of World War I came, it could not begin to meet the German Navy in battle on the open sea.[54]

He sees the Russian experience in World War II as once again confirming the principle of coordinating the efforts of all of the armed forces. Here strategic utilization of naval forces was dictated by the requirement to tie closely their operational plans with that of the Soviet Army and with the objective of destroying the main enemy forces on land. Thus, the Navy served effectively to protect the strategic flanks of the ground front as it destroyed enemy seapower in the Barents, Baltic and Black Seas.[55]

Post World War II era

He indicates that the post-World War II era has stimulated an even more critical need for developing a powerful Navy:

> "The need for having a powerful Navy corresponding to the geographic position of our country and her political importance as a great power has been obvious for a long time. However, the problem became especially acute in the postwar years when, as a result of changes in the alignment of forces in the world arena, the USSR and other Socialist countries found themselves surrounded by a hostile coalition of seapowers, a situation which raised the threat of nuclear attack from the sea."[56]

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[54] Ibid., pp. 116 - 117.

[55] Ibid., p. 185.

[56] Ibid., p. 183.

In the immediate postwar years conflicting requirements pulled the Soviets in several directions as they sought to contend with this new threat. The primary mission of the armed forces was defense of the Soviet State and the new territory that had been acquired as a result of the war. At the same time, however, the Soviets recognized that their potential interests encompassed lands and seas far beyond their immediate borders and that of their satellites. Thus, on the one hand, they may have viewed the next major battle ground as being the land mass of Central and Western Europe where both they and the U.S. were filling political, economic and military vacuums. On the other hand they also believed that to defend the state in this new era, they would have to intercept U.S. warships and troopships well beyond the territories under their control if in the event of a clash, U. S. forces attempted to reinforce Europe, the Middle East or Asia.

In the late forties and early fifties, Admiral Kuznetsov, Gorshkov's predecessor, pursued continuation of a policy that Stalin had determined in the mid-1930s, but which had been interrupted by the war. This effort called for the proceeding with the construction of major capital ships in an attempt to emulate existing Western fleets. It stood in contrast with a more pragmatic solution advocated by a "young school" within the Navy of which Gorshkov was a member. This school recommended addressing the immediate

problem of extending Soviet defenses beyond the near shore by relying on submarines, naval aviation, and smaller craft to provide depth to coastal defenses.[57]

His Approach to Navy Building

When Gorshkov assumed the leadership of the Soviet Navy, he had the opportunity to deal with the postwar threat in his terms. Evidently his accession to power came to implement new decisions of the Central Committee regarding the direction of the navy as it corresponds to a period of intense debate at that level after Stalin's death and Khrushchev's assumption of the premiership. Thus, it was the political system that formulated the new direction and he was quick to reinforce ideas that may have paralled his own. He writes in Seapower:

> "The direction of the development of our Navy was determined by the CPSU Central Committee as early as the mid 1950s, the establishment first and foremost of powerful submarine forces and naval aviation, the equipping of the Navy with nuclear-missile weaponry, and the employment of nuclear power in submarine construction were envisioned. A definite role was also assigned to the construction of surface ships, without which the accomplishment of a series of tasks levied on the Navy is impossible. In this connection, the need for balanced naval forces was taken into account."[58]

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[57]For a discussion of Soviet naval initiatives in the immediate postwar era, see Polmar, Soviet Naval Power: Challenge for the 1970s, Chapter 2, pp. 19-30.

[58]Gorshkov, Seapower, p. 359.

As a Conceptual Theorist

One might read the adaptibility and flexible thinking of the Conceptual Theorist into his implementation of the Central Committee's policy direction and, indeed, to numerous actions throughout his career. While paying attention to historical precedent, he has been known for his ability to appreciate changes in the methods of combat and to assess properly current trends and situations. His reputation as an innovator with a flair for creative leadership certainly played a role in his selection as one of the youngest officers in any navy to attain the rank of Rear Admiral. This he accomplished when he assumed command of the Sea of Azov Flotilla in World War II at the age of 31. Throughout the war, he was confronted with a variety of operational problems, but none was a hinderance to his success. He was equally effective in the cruiser destroyer forces as when he employed small coastal and riverine craft. He was able to direct large and complex amphibious operations and even commanded large ground forces in combat.[59]

The following description of his approach points further to his Conceptual Theorist underpinnings:

[59] Polmar notes that the contacts Gorshkov made in this period with men who were later to hold key military and political positions in the Soviet Union may have been even more significant than the successes he realized in battle. These included Khrushchev, Brezhnev, Malinovskiy and Grechko. Soviet Naval Power: Challenge for the 1970s, p. [illegible].

"If the Russians had followed the Western path of naval development, they would have found themselves in the position of the relative novice competing with an old hand in an established, relatively routinized trade, which did not auger success. On the other hand, by taking advantage of the emerging 'revolution in military affairs' as it applied to the navy - nuclear propulsion, nuclear warheads, ballistic and cruise missiles, electronics - the USSR could select the grounds of competition on which both East and West were starting more as equals."[60]

It is also his focus on the enemy and ways to counteract the opponent's capabilities and strategy that reinforces his Marxist predilection toward dialetical thinking. In another passage, Gorshkov admits taking specific satisfaction from such a reasoning process.

"It is interesting under present-day conditions to follow from an historical point of view the dialectical relationship between the development of naval forces and the goals of that policy of the states which they were designed to serve."

He made this comment when reflecting on Lenin's statement that "Policy is a thought process, while war is merely a tool, and not the reverse. Consequently, the only recourse is to subordinate the military point of view to the political." Gorshkov firmly believed, in this regard, that "military operations at sea, as well as on land, are subordinate to general, constantly functioning laws, and they cannot be conducted in isolation from the goals of that policy of which war is an extension."[61]

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[60]Gorshkov, Seapower, p. 304.

[61]Ibid., p. iv.

Influence of other scientific approaches

His full intellectual orientation is not limited to that of the Conceptual Theorist, however, it embraces aspects of other scientific approaches. He includes a definite appreciation and application of the methods of the Analytical Scientist. He employs these, however, as would the Conceptual Humanist. In this regard, his approach bears the marks of being partisan, holistic, imaginative, problematic and being based upon multiple causation. The Conceptual Humanist is also reflected in his fervent belief in the navy as a legitimate, effective means to pursue the goals of the state and preserve the security of the nation. Particular Humanist influence shows through in his ideological justification for naval system development and activity. It is accentuated by his long, intense personal involvement with the building of the navy and the success of his action oriented struggle to achieve his programs.

As a Systems Analyst

In summary, his approach extends to that of the integrative systems thinker to include reliance on multiple disciplines and participant interaction as the next passage demonstrates.

> "To ensure the Navy's capability to carry out operational-strategic missions, scientific research is being conducted to determine the

> nature of the Navy's balance, the overall qualitative and quantitative makeup of ships and aircraft, and the distribution of forces by theater and base area. Thus, the development of the Navy requires serious and profound scientific research. Here, a display of voluntarism or of subjective principles is totally impermissible. The greater the attention that leaders who are making responsible decision on the development of the Navy pay to the recommendations of the research institutes and to the opinions of the practitioners, the naval officers, and the more they take into account the capabilities of industry, the more correct their decisions will be, the less painful the process of building a Navy will be, the fewer funds will be needed in the final analysis to build it, and the more powerful it will be. Such an approach to the problems of building the Navy assumes the comprehensive development of scientific methods of management. The scientific method of managing the building of the Navy requires extensive multidiscipline scientific research work in the area of engineering-technical and operational-tactical problems. It assumes a strict system of optimization, ensuring selection of the most rational option based on quantitative analysis and military-economic justifications, and built according to standard criteria and close tolerances."[62]

Application of principles of scientific management

How then did Gorshkov apply the principles of scientific management to implement the Party directives for the Navy and pursue the concept of naval balance? He describes the process from this by now familiar perspective:

> "The manner of balancing a navy is not fixed; under certain historical conditions it can change. The main factors governing such change are the world political situation (new alignment of forces, presence of military blocs, changes in the regimes of individual countries, and so forth), economic capabilities and the growth of the military-economic

[62] Ibid., pp. 234, 235.

potential of a country, the development of domestic and foreign science and technology, and a change in the missions assigned to the navy. Of all of these factors, the main ones are the missions assigned to the navy by the political leadership, and the level of the country's economy, above all the capabilities of the shipbuilding, instrument making, aircraft and other sectors of industry engaged in the construction of ships, aircraft, weaponry and combat equipment."[63]

His Concept of Naval Missions

For the submarine force

He saw a new and primary mission for the Navy that would allow it to assume the strategic offensive in a credible fashion.

> "Alongside one of the most important and comprehensive missions of the Navy - the destruction of enemy ships - a qualitatively new mission has appeared: the crushing of the military-economic potential of the enemy through direct action from the sea against his vitally important centers."[64]

For Gorshkov, heavy emphasis on submarines became the means to achieve this end as rapidly as possible.

> "Giving the priority to the development of the submarine forces made it possible in the shortest possible time to increase sharply the attack capabilities of our Navy, to pose a serious threat to the main forces of the enemy navy in the ocean theaters, and, at a cost of fewer resources and less time, to intensify the growth in the maritime might of our country, depriving the enemy of those very advantages which he could have had at his disposal in the event of war against the Soviet Union and the countries of the Socialist Community."

Further, he strongly felt that the development of the submarine forces provided "a qualitatively new technical base

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[63] Ibid., p. 324.

[64] Ibid., p. [illegible].

that made it possible for our Navy to abandon its many years of attachment to coastal areas and closed seas, to expand considerably its sphere of operations on the oceans, and in the event imperialists unleash war, to carry out its own missions of an operational-strategic nature in combat with the fleet of the aggressor in areas of the ocean selected by us."[65] In the sixties the development of the submarine forces reached the stage where it included the cruise and ballistic missile capability required for the prosecution of strategic missions against land targets and new refinements to this strategic potential have been added ever since.

For naval air

While submarines were relied upon to provide the strategic offensive from the sea against enemy land targets and in the sea against the enemy's main naval forces, Gorshkov also sought the development of long range aircraft strike capabilities to complement the latter submarine mission. He states with pride concerning the status of the air arm when he wrote Seapower in the mid 1970s:

> "Today they can direct their main efforts against strike forces of surface ships, submarines and transports, including those with troops and cargo in transit or in port, and can also destroy the

[65]Ibid., p. 240.

most diverse, mobile, highly maneuverable small targets at sea."

Later he decreed that:

"The combat capabilities of Naval Aviation are one of the main indicators of the striking power of our modern navy. Naval Aviation has become truly oceanic in nature, and it has been transformed into a most important naval warfare resource."[66]

For surface forces

That the role of surface ships was seen to encompass a series of tasks has already been indicated. Gorshkov envisioned these to include many of the familiar naval missions; operations against sea lines of communications, in closed theaters and coastal areas, gunfire support of ground troops, carrying out amphibious landings, blockade operations, etc. The primary mission emphasis, however, he believes to be twofold and related to the strategic defensive. These missions demonstrate the significant priority in the Soviet Navy on anti-submarine Warfare. They include not only the protection of surface forces against intruding submarines, but also in particular, the protection of the Soviet Navy's principal strike arm, its missile submarines, from surface, air and submarine attack. The surface navy closely coordinates its operations with the air arm in both these roles.

The Soviet response to the Western submarine threat

[66]Ibid., pp. 253 and 255.

Gorshkov now calls "a national, not just a naval mission."[67] He returns time and again to the theme of faulting the German Navy for their independent development of their submarine force in the World Wars. He belives the assumption of the submarine preceeding independently from its base and remaining concealed within the ocean depths to assure its invulnerability is a mistaken one. He points to the fact that German submarine losses increased throughout the war and attributes this to the intensity of the allied ASW effort which, given the unsatisfactory combat and operational support of their submarine force by the German High Command, completely disrupted the unrestricted submarine warfare campaign.[68]

He states that technical improvements now allow the organizing of submarine combat operations in a completely new manner to achieve close coordination in battle with surface ships. He takes reassurance in the positive quality of surface ships reflected in their ability to maintain two-way communications with shore posts, which facilitates control by ensuring the timely transmission of necessary orders to all fleet units to include subsequent relay of these orders to the submarines by their accompanying surface protectors. Gorshkov considers this capability to be

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[67] Hibbits, "Gorshkov's Writings" in Naval Power in Soviet Policy, p. 5.

[68] Gorshkov, Seapower, p. 239.

absolutely essential in a prewar (deployment) situation.[69]

Other modern hardware that the Soviet Navy has applied toward increasing the viability and effectiveness of its surface forces has included long range missiles of various types, improved guns with accompanying sohpisticated radar detection and fire control equipment, and upgraded sonars so vital to the ASW effort. The air arm has been sent to sea on board helicopter carriers and cruisers. It now includes VSTOL aircraft on board the KIEV class ships. Surface-effect ships and hydrofoils also have been introduced, but Gorshkov only sees these as a transition stage.

> "Hydrofoil ships can be regarded as a transitional stage in the development of modern surface ships which differ in principle from displacement ships. These ships are air cushioned vehicles and wing-in-ground effect vehicles, whose development is receiving a great deal of attention abroad. The air cushioned principle is applicable to ships of various displacement up to ocean going ships. Possessing a speed of greater than 100 knots, this kind of ocean going ship is capable of crossing the Atlantic Ocean in 30 to 40 hours, whereas the conventional transport takes up to eight days or more....The main tactical property of air cushioned vehicles lies in their ability to move over the water surface and over land, even over ice cover, and their ability to move over shallow water areas, and move freely from water, to land, to ice covered areas, and back again. All of this combined with high speed and high cargo-carrying capacity, give the new ships a series of highly significant tactical advantages."[70]

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[69] Ibid., pp. 246 and 248.

[70] Ibid., p. 250.

The Soviet Employment of Seapower

Periods of Peace

It has been almost a quarter of a century since Admiral Gorshkov assumed the watch as Soviet Commander-in-Chief of the Navy. This period has been a time of relative peace as far as armed clashes between the Warsaw Pact and the West is concerned. Now that his concepts of seapower and navy building have been documented in this chapter, how has he utilized this period to achieve his objectives? What are the observed results? What has happened to the scope and level of Soviet naval activity as Gorshkov strove to implement his concepts of Seapower? The remainder of this chater is devoted to providing documentary answers to these questions. Turning once more to Admiral Gorshkov as he outlines the measures he has taken:

> "Establishing conditions for gaining sea control has always required lengthy periods of time and the execution of a series of measures while still at peace. These measures include development and preparation of the necessary forces and material and maintaining them in readiness to accomplish combat missions, concentration of groupings of forces and disposing them in groupings in a theater in such a manner that they will have superiority of position over the enemy, and also providing of facilities in the sea and oceanic theaters of military operations, the proper organization of forces and a base system appropriate to their mission, a system for controlling them, and so forth."[71]

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[71] Ibid., p. 297.

Soviet Goals

While expanding the activities of his Navy far beyond the borders of the Soviet Union's primary sphere of influence, he takes his cue from what he perceives as the main goal of the USSR.

> "For the Soviet Union, whose main goal is the building of Communism, and a steady improvement in the standard of living of the builders of Communism, seapower is emerging as one of the important factors strengthening its economy, accelerating its scientific and technical development, and consolidating the economic, cultural and scientific ties between the Soviet people and the peoples in countries friendly to them."[72]

In another passage, he returns to this theme.

> "The growing sea might of our country is supporting the successful conduct of its foreign policy, permits it to expand trade constantly, transport scientific and cultural ties with other countries, and to strengthen constructive cooperation between states with different social systems, and puts an important instrument in the hands of our people for carrying out their historical mission, the expansion of economic aid to all countries which are on the path to independent development."[73]

He takes particular pride in the capacity of his Navy to pursue such activities.

> "Yet the military aspects examined by us are not the only aspect which exert an effect on the role of navies. Navies, while remaining a highly effective and indispensable means of armed combat, also are constantly being utilized as an instrument of state policy in peacetime. The sea is a no-man's land, and therefore navies do not encounter in their

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[72] Ibid., p. 2.

[73] Ibid., p. 71.

activities many of the limitations that prevent utilization of other branches of the armed forces in peacetime for political purposes."[74]

Expansion of Seapower's Auxiliary Components

The fishing industry

The first step in the review of the documentary evidence of the observed results entails an examination of the progress made by the Soviet Union with regard to each of the components of seapower. A substantial investment of approximately seven billion rubles was made in shipbuilding for the Soviet fishing industry between 1950 and 1976. This effort made it possible to sustain an annual growth rate of over 13 percent making the fishing fleet the world's largest and most modern by the end of that period. The Soviet Union was second to Japan in terms of live weight catch, had 38 percent of the world's "catching power" and 85 percent of the world's carrier tonnage. Table 4 illustrates this expansion in terms of gross rate tonnage, while Table 5 depicts the average fish catch by areas shown in Fig. 14. Of even greater significance has been the continuing interaction with Third World nations as a result of Soviet fishing activities. This access has provided the foundations for further entry to these nations and is illustrated in Tables 6 and 7.[75]

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[74]Ibid., p. 358.

[75]Primary sources included: (1) Review of Fisheries in OECD Member Countries, 1974, (Paris: Organization for

(Continued on p. 154)

TABLE 4

Expansion of Soviet Fishing Fleet, 1950 - 1975
(100 GRT and Above)

Year	Units	GRT (Thousands)	Average Annual Increase (Tonnage)
1950	358	300	–
1955	1,379	734	18.5%
1960	2,588	1,760	17.7%
1965	3,373	3,301	12.1%
1970	4,165	5,194	8.8%
1975	4,363	6,600	5.2%

TABLE 5

USSR Fish Catch by Areas

	Average 1966-70		Average 1971-75	
	Thousand Metric Tons	Percent of Catch	Thousand Metric Tons	Percent of Catch
World-wide total	6,134.1	100.0	8,569.5	100.0
Near Fisheries:				
Inland/Black Sea/Med.	1,063.9	–	1,185.3	–
NW Pacific	1,287.9	–	2,061.2	–
Total near		38.3		37.9
First movement out:				
NE Atlantic	1,343.6	–	1,732.9	–
Total first		21.9		20.2
Second movement out:				
NW Atlantic	810.7	–	1,171.8	–
E. Central Atlantic	346.7	–	966.7	–
W. Central Atlantic	14.6	–	37.7	–
NE Pacific	587.5	–	626.8	–
Total second		28.7		32.7
Third movement out:				
SE Atlantic	385.3	–	535.2	–
SW Atlantic	290.8	–	11.8	–
W. Indian Ocean	38.4	–	117.2	–
E. Central Pacific	19.7	–	41.2	–
SW Pacific	0.0	–	67.1	–
SE Pacific	0.0	–	14.8	–
Total third		12.0		9.2

Fig. 14. Soviet Fishing Areas, 1976-1977

TABLE 6

Countries Offered Soviet Fishing Aid, 1964-1976

Africa	Middle East	South and East Asia
Algeria	Egypt	Bangladesh
Angola	Iran	India
Benin	Iraq	Indonesia
Equatorial Guinea	North Yemen	Pakistan
Gambia	South Yemen	Sri Lanka
Ghana	Syria	Vietnam
Guinea		
Guinea-Bissau		
Kenya		
Mauritania	**Europe**	**Latin America**
Mauritius		
Morocco	Greece	Argentina
Mozambique	Portugal	Chile
Senegal		Cuba
Sierra Leone		Peru
Sudan		
Tanzania		
Tunisia		

TABLE 7

Soviet Joint Fishing Ventures

Underway		Under Negotiation
Angola	Mozambique	Argentina
Benin	Philippines	Bangladesh
Egypt	Sierra Leone	Ecuador
Ghana	Singapore	Gambia
Guinea-Bissau	Somalia	Guyana
Iraq	Spain	Indonesia
Mauritania	South Yemen	Liberia
Mauritius	Sri Lanka	Malaysia
Morocco	Tunisia	Peru

The merchant fleet

The Soviet Merchant Marine has increased over six times since the 1950s. While this growth is significant, Davidchik and Mahoney assess it as following world shipping trends in general. An improvement in the relative standings vis-a-vis other world merchant fleets has been realized, but not by a substantial amount. Soviet inputs to their fleet tend to be smaller, slower, and less technologically advanced than those of Western nations. The Soviets are beginning to build new supertankers, however, and it appears they intend to triple their purchases of large, automated roll-on/roll-off ships, which will enhance significantly their capacity to ship military and other equipment to underdeveloped or overcrowded harbors and drive it off in assembled condition ready for use. Older ships have been replaced rapidly and overall 65

Economic Development and Cooperation, 1974), pp. 26, 27; (2) Year Book of Fishery Statistics, 1975, Vol. 40 (Rome-Office of International Fisheries, Food and Agriculture Organization, United Nations 1976), p. 269; (3) 1970, Vol. 30; (4) 1974, Vol. 34; (5) A.S. Bogdunov, Soviet Fisheries Investigations in the Indian Ocean, (Washington, D.C.: National Marine Fisheries Service, National Oceanographic and Aironautics Administration, U.S. Department of Commerce, 1973). The data was compiled in this form by Michael D. Davidchik and Robert B. Mahoney, Jr., analysts for the Center for Naval Analyses, an affiliate of the University of Rochester under contract to the Department of the Navy. The tables were extracted from "Soviet Civil Fleets in the Third World", Appendix A to Bradford Dismukes and James McConnell, eds., Soviet Naval Diplomacy, (New York: Permagon Press, 1979), pp. 324 - 330.

percent of their tonnage is less than ten years old. Table 8 provides trends in Soviet and world shipping. This growth in the merchant marine has paralleled the expansion in Soviet foreign trade that has occurred since 1955 as shown in Table 9. The nations involved in this trade are depicted in terms of merchant marine port visits in Table 10. These calls were increased some 60 percent between 1965 and 1975. Like fisheries cooperation, recent Soviet merchant marine activities have included joint ventures such as the creation of firms with the following countries: Sri Lanka, Egypt, Spain, The Philippines, Iraq, and Somalia.

Although they average over a billion dollars a year, arms transfers reflect a relatively small portion of this trade, which seems to be based more on economic reasons than politico-military. The latter flavor, however, is conspicuous with regard to particular client states including Cuba and certain Middle Eastern countries. It is estimated that of the approximately 800 merchantmen under Soviet flag on the high seas on any given day, only five percent carry cargoes that can be said to be military related. Intensive resupply efforts such as those carried out during the October 1973 Middle East War and the Angolan Civil War do not seem to detract significantly from this percentage. The tanker force, while participating primarily in commercial ventures, also provides considerable support

to Soviet naval units. This has the advantage of earning their keep while supporting the Navy and, since the commercial fleet is not subject to the same restrictions as warships, a merchantman can also enter port freely and purchase fuel, water and foodstuffs that later may be transferred to the fleet. As shown in Table 10, Soviet merchant fleet visits to Third World ports have increased from an average of 4,550 per year in the period 1967-1970 to an average of 6,850 per year in the period 1971-1974. This represents a percentage increase from 75% to 82% of the total ships' calls to foreign ports made by the Soviet merchant fleet.[76]

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[76] Primary sources included: (1) Handbook of Economic Statistics, ER-77-10537, (Washington D.C.: Central Intelligence Agency, 1978), pp. 152 and 159. (2) World Military Expenditures and Arms Transfers, 1965-1975, (Washington, D.C.: 1976), p. 69. Both were taken from Davidchik and Mahoney, "Civil Fleets", pp. 318 - 324.

TABLE 8

Trends in Soviet and World Shipping

Year	USSR DWT	World DWT	USSR as % of World	USSR # Units	World # Units	USSR as % of World
1950	1.8	107.2	1.7	432	13,282	3.3
1955	2.4	130.0	1.8	604	15,148	4.0
1960	4.9	171.9	2.8	873	17,317	5.0
1965	8.0	214.1	3.7	985	17,825	5.5
1970	11.8	325.1	3.7	1,395	19,503	7.1
1975	15.3	556.7	2.7	1,660	22,391	7.4
1976	16.5	597.1	2.8	1,707	22,920	7.4

TABLE 9

Soviet Imports Plus Exports by Groups of Nations (Billions in U.S. $)[a]

			Non-Communist	
Year	Total	Communist[b]	Developed	Less Developed
1955	6.5	5.1	.9	.3
1960	11.2	8.2	2.0	1.0
1965	16.2	11.2	3.0	2.0
1970	24.5	16.0	5.1	3.4
1975	70.2	39.5	21.3	9.4
1976	75.7	41.8	24.4	9.5

[a]Research Aid – 1977, CIA, p. 59.

[b]The Communist category includes the PRC, Cuba, North Korea, and Mongolia. The less developed non-Communist category includes Spain, Portugal, and Greece.

TABLE 10

Estimated Annual Merchant Ship
Visits to Third World States

Nation	1967-70 (average)	1971-74 (average)
Cuba	1,250	1,600
Egypt	600	1,100
India	350	400
Greece	300	400
Lebanon	200	200
N. Vietnam	250	250
Syria	200	300
Turkey	200	250
Singapore	250	400
Cyprus	100	100
Algeria	200	300
S. Yemen (PDRY)	100	–
Morocco	150	200
Spain	200	350
N. Korea	100	150
Libya	100	150
Iraq	–	200
Malaysia	–	200
Brazil	–	150
Tunisia	–	150
Sum	4,550	6,850
Other calls to Third World States	1,500	1,500
Sum as % of Total	75%	82%

Notes: Nations with fewer than 100 calls are excluded from the table or from particular columns, as appropriate.

Expansion of Naval Capabilities

Major combatants and submarines

Returning to the principal component of seapower, the Navy, the period from 1957 to 1975 (the assumption of leadership by Gorshkov to his publication of Seapower) is a direct reflection of the concepts he espoused. It can be conceived in terms of qualitative gains over the quantitative increases in large capital ships that resulted from the Stalin-Kuznetsov directed program in the immediate post-war era. This transformation is depicted in Table 11. While the overall numbers of units are down, total combatant tonnage is increased by about 40 percent. The tonnage increase may be attributed directly to the substantial increase in ballistic and cruise missile submarines (from 5 to 860 displacement tons). In terms of investment value, the increase for major surface combatants is even more startling (about 600 percent - note that the figures given in the table are in terms of 1957 values). The 1957 submarine force was almost totally conventional from the standpoint of both propulsion and armament. In 1975, 65 to 70 percent were nuclear powered and 60 to 75 percent were missile armed. In 1957, the air arm had yet to come on board the fleet, nor were missile launchers prevalent in the surface fleet. In 1975, two-thirds of the cruiser/destroyer force in terms of full load displacement had these capabilities.[77]

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[77] James McConnell, "Doctrine and Capabilities" in Soviet Naval Diplomacy, p. 17.

TABLE 11

Number of Units, Tonnage and Investment Value of the Soviet Combatant Fleet, 1957 and 1975

Type of Combatant	Number of Units		Displacement (000's tons)		Index of Investment Value (1957 total=100)[a]	
	1957	1975	1957	1975	1957	1975
Submarine:						
Ballistic-Missile	2	75	5	555	0	176
Cruise-Missile	0	67	0	305	0	60
Torpedo-Attack	475±	193	500	500	27	58
Surface:						
Cruisers	30[b]	29	480	320	18	35
Destroyers	130	82	370	305	17	40
Escorts	90	105	115	135	6	10
Total Major Combatants	727±	551	1470	2120	68	378[c]
Minor Combatants			325	410	32	73
Total Combatants			1800[c]	2530	100	451

Note a: Investment values determined on the basis of the basic values per ton for the respective ship categories during various construction periods given in Stockholm International Peace Research Institute, World Armaments and Disarmaments: SIPRI Yearbook 1975.

Note b: Includes two battleships.

Note c: Total does not add because of rounding among individual components.

<u>Naval air</u>

Soviet Naval Aviation also has been transformed into the Gorshkov image. Under the Stalin program in the early 1950s, it numbered nearly 90,000 personnel and some 4,000 aircraft. Its composition, however, emphasized fighter aircraft cover which could provide an air defense umbrella over the fleet at only short combat ranges from the bases ashore. A limited number of jet bombers were employed as a small strike force, for reconnaissance, and elementary ASW operations. Some 1,500 to 2,000 of these aircraft were lost to the National Air Defense Command in an armed forces reorganization carried out under Khruschev in the late 1950s. The 1978 air order of battle is depicted in Table 12. The aircraft involved include the subsonic TU-16 BADGER with an operational, unfueled combat radius of a little over 1,200 NM; the supersonic TU-16 BLINDER, Mach 1.4, with a slightly greater combat radius; and the recently introduced (1974) variable geometry wing bomber BACKFIRE, Mach 2+, with a range of from 5,000 to 6,000 NM. All of these strike aircraft are equipped with standoff missiles and carry electronic warfare penetration packages. The IL-38 MAY and the BE-12 MAIL are the mainstays of shorebased ASW air. The former has a maximum range of about 2,500 NM at 280 knots, while the latter can cruise at 270 knots to a range of about 2,000 NM. Long range reconnaissance is provided by the TU-95 BEAR, which can

cruise at better than 400 knots and has an unrefueled combat radius of over 4,000 NM. BEARs have made numerous nonstop flights to Havana, Cuba, and Conakry, Guinea. Some also are configured for ASW operations. Tactical air now includes the shorebased SU-17 FITTER bomber and, as indicated earlier, the VSTOL FORGER Is being introduced to the fleet to upgrade seabased capabilities. Fig. 15 gives a comparison of the coverage that can be provided by the various strike, ASW and reconnaissance aircraft.[78]

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[78] Primary source: "General George S. Brown, Chairman of the Joint Chiefs of Staff, United States Military Posture for 1979, (Washington, D.C.: Department of Defense, January 1978), p. 20, as quoted in Paul J. Murphy, Morskaya Aviatsyia (Soviet Naval Aviation): Its Development, Capabilities and Limitations", in Naval Power in Soviet Policy, pp. 182.

TABLE 12

Soviet Naval Aviation Order of Battle
(as of 1 January 1978)

Naval Aircraft		Number	
Strike Medium Bombers	about	375	
Tankers	about	90	
Reconnaissance	about	150	
ASW		400	
Transport		200	
Training		50	
Fighter Fighter Bombers		75	
		1,340	Total

Fig. 15. Ranges of Soviet Strike and Reconnaissance Aircraft

Minor combatants, auxiliaries and service craft

The remainder of the Soviet naval order of battle is depicted in Tables 13 through 17. Displacements for the Coastal Patrol Fleet run up to 900 tons, while combat ranges vary up to 800 NM. Equipped with a host of guns, torpedoes and various kinds of missiles, they provide potent defense in home waters. Long proponents of mine-warfare, most combatants, submarines and the major aviation units are capable of laying mines. In addition to the naval minesweepers, large numbers of the fishing fleet have been designed to double as sweepers should the situation require effort beyond the Navy's capability. Further, helicopters are being used more and more in conjunction with surface units in minesweeping exercises. Seven classes of landing ships have entered service since the 1950s. The RAPUCHA class, which is built in Poland and became operational in 1975, is assumed to have a good troop/tank load capacity, a roll-on/roll-off capability, and improved mechanical and armament features. Fast Hydro-foils and air cushioned vehicles have been used to land marines in Soviet combined arms exercises. The larger wing-in-ground effect vehicle tested by the Soviets and called the EKRANOPLAN is said to be capable of carrying up to 900 troops from the water across the ice and marshes as described in a previous section. The Soviets designate

the EKRANOPLAN as a multi-purpose vehicle that can be used for a variety of missions ASW, minesweeping, patrol and fast supply. As indicated in Table 17, the auxiliary forces are the largest component of the Soviet fleet and they include a wide variety of support and transport vessels. As mentioned earlier, the merchant fleet augments the services provided by these units. Of particular note are the 56 intelligence collectors, which probably are the most active units in the Soviet Navy that deploy throughout the world on a regular bases.[79]

TABLE 13

Coastal Patrol Fleet Order of Battle
(as of 1 January 1978)

Type	Class Name	Total Numbers
Patrol Escorts	POTI	
	GRISHA	95
Patrol Guided Missile Combatants/Missile Attack Boats	NANUCHKA	
	KOMAR	
	OSA I & II	120
Submarine Chasers	STENKA	
	TURYA	
	SO I	
	MO VI	130
Other Patrol and Torpedo Types	SHERSHEN	
	P 6	
	P 4	
	MO I	135
		390

TABLE 14

Platforms for Minelaying

Special Minelayers	Principal Surface Combatants	Small Combatants	Naval Aviation Aircraft	Submarines
ALESHA	CHAPAYEV	GRISHA	BADGER	All classes of submarines
	KASHIN	KRONSHTADT	BEAR	
	KOLA	PETYA I & II	BLINDER	
	KOTLIN	P4 P6 P8 P10	MAIL	
	KRIVAK	SHERSHEN	MAY	
	RIGA	SO I	Others	
	SKORYY	T43		

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[79] Murphy "Trends in Soviet Naval Force Structure", in Naval Power in Soviet Policy, pp. 117, 122, 125 and 126.

TABLE 15

Minesweeper Order of Battle
(as of 1 January 1978)

Type	Class	Total By Type
Special Minelayers	ALESHA	
Minesweepers	NATYA	
	K8	
	SASH	
	SONYA	
	T43	
	T58	
	T301	
	TR40	
	ZHENYA	
	VANYA	395

TABLE 16

Amphibious Order of Battle
(as of 1 January 1978)

Type	Class Name	Total By Type
Large tank/troop landing ship	ALLIGATOR	
	RAPOCHA	
Medium landing ship	POLNOCNY	
	ROBBE	
Small vehicle landing ship	MP-4	83
Smaller utility (tanks & troops) landing craft	MP-10	
	SMB-1	
	VYDRA	60
		143

TABLE 17

Auxiliary and Service Craft Order of Battle (as of 1 Jaunary 1978)

Type	Ship Name	Total
Transport Oiler	SOFIA	1
Small Oilers	ALTAY	
	BASKUNCHAK	
	DORA	
	KHOBI	
	KONDA	
	NERCHA	
	OLEKMA	
	PEVEK	
	+4 ships	41
Replenishment Oilers	BORIS CHILIKIN	
	KAZBEK	7
Small Replenishment Oilers	DUBNA	
	UDA	9
Missile Support Ship	AMGA	
	ANDISHAN	
	LAMA	9
Repair Ship	AMUR	
	OSKOL	
	TOVDA	28
Submarine Tender	DNEPR	
	DON	
	UGRA	20
Small Submarine Tender	ATREK	
	TOMBA	7
Submarine Rescue Ship	NEPA	
	PRUT	
	T 58	23
Cargo Ship	ANDIZHAN	
	KOLOMNA	
	+3 ships	7+
Light Cargo Ship	KEYLA	
	LENTRA	
	TELNOVSK	
	SEKSTAN	
	+7	60
Water Carrier	VODA	
	+1	15
Ocean Tugs	INGUL	
	KATUN	
	OKHTENSKY	
	OREL	
	PAMIR	
	PRIBOL	
	ROSLAVL	
	+4	100++
Degaussing Ship	SEKSTAN	
	+3	45+
Intelligence Collector	DNEPR	
	LENTRA	
	MAYAK	
	MIRNY	
	MOMA	
	OKEAN	
	PAMIR	
	PRIMORYE	
	N. ZUBOV	
	T 58	56
Surveying Ship	BIYA	
	KAMENKA	
	LENTRA	
	LENTRA MOD	
	MELITOPOL	
	MOMA	
	SAMARA	
	TELNOVSK MOD	100
Salvage Ship	T-43	9
Cable Repair Ship	KLASMA	
	+4	10+
Other Auxiliaries		260+
		400
		1,207

Expansion of Naval Activities

Trends in out-of-area deployments

Fig. 16 depicts the locations of the four Soviet Fleet Headquarters.[80] When the primary mission of the Soviet Navy in the 1950s was defense in depth of the coastal areas of the USSR, naval units rarely ventured from these waters. Most naval activity, thus, was conducted in what Western analysts termed in-area. For the Northern Fleet this corresponded to the Barents and White Seas. For the other fleets these waters included the Baltic and Black Seas, while in the Pacific operations were limited mainly to the Sea of Japan and the Sea of Okhotsk. Only one naval base, Petropovlosk at the southern tip of the Kamchatka Penninsula had open access to the Pacific or any major ocean.

The author's career, which commenced in the early sixties, spans a period when if one or two Soviet combatants were steaming out-of-area (beyond the seas indicated above), it was regarded as a major intelligence event; to the time when in 1973, as he was serving with the U.S. Sixth Fleet during the October Arab-Israeli War, his Joint Intelligence Center on board the amphibious command ship USS MOUNT WHITNEY tracked up to 99 Soviet vessels in the Mediterranean alone. Soviet out-of-area operations

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[80] Charles C. Petersen, "Trends in Soviet Naval Operations", in Soviet Naval Diplomacy, p. 39.

have thus intensified considerably since those early days. Beginning in the early 1970s they have been conducted on a regular basis and have become world wide in scope as documented throughout the remainder of this section.

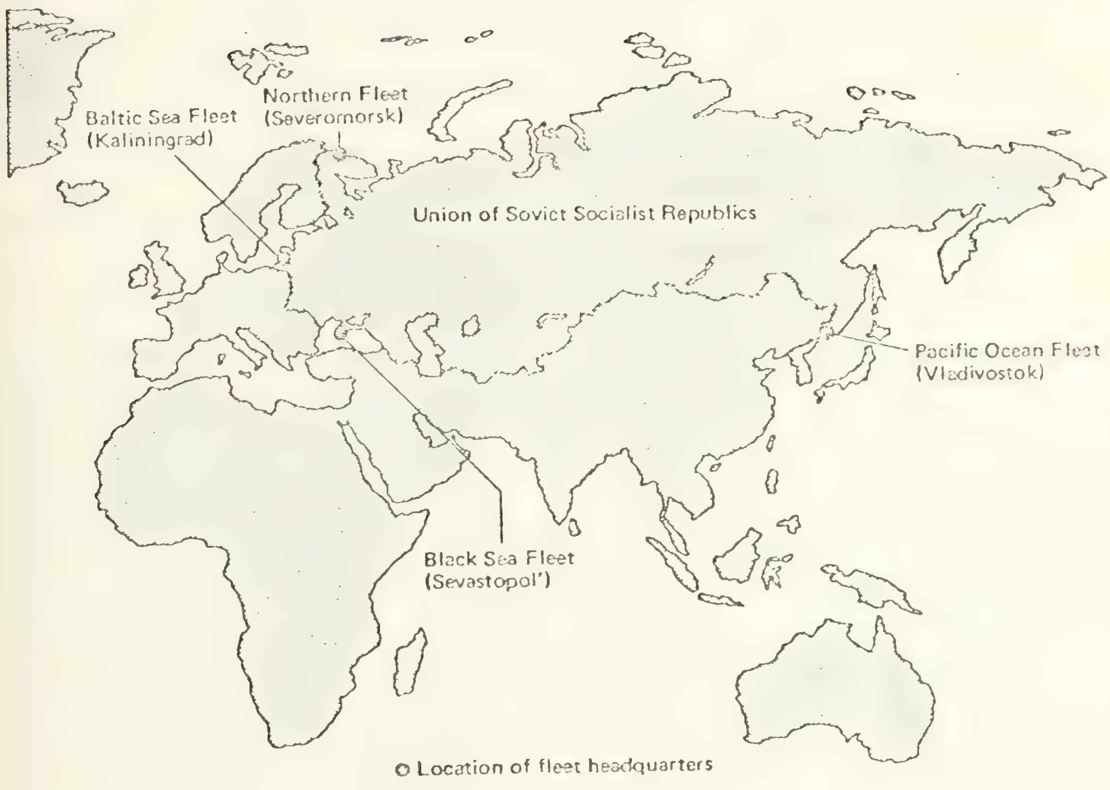

Fig. 16. Home Waters of the
Four Soviet Fleets

Surface and submarine forces

Tables 18 through 21 provide a measure of both the flavor and extension in scope of these operations in the Atlantic Ocean, Mediterranean Sea, Indian and Pacific Oceans.[81] Diesel submarines were among the earliest units to deploy to all areas. The late sixties brought both cruise and ballistic missile deployment on a regular basis to include stationing of ballistic missile patrols continuously since the early seventies off both the east and west coasts of the United States. Surface unit deployments have included the major commitment of the Fifth Eskadra to the Mediterranean (with an order of battle comparable and many times exceeding that of the U.S. Sixth Fleet) and the Tenth Eskadra in the Indian Ocean, which has gradually risen from a modest commitment of 14 units in 1968 to the point where it began to exceed 30 units on a regular basis in 1973. Fig. 17 and Tables 22 and 23 provide graphical and statistical breakdowns of these deployments.[82] Regular patrols conducted by both intelligence collection units and combatants on a continuous basis throughout the world are depicted in Figs. 18 and 19.[83] Other areas to which the Soviets have

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[81] Petersen, "Trends in Soviet Naval Operations:, in Soviet Naval Diplomacy, pp. 77 - 84.

[82] Ibid., pp. 48, 73 and 74.

[83] Ibid., pp. 53 and 55.

sent regular surface deployments include Cuba, Guinea and the Western Hump of Africa, Angola and southern Africa, and since the U.S. withdrawal from Vietnam and subsequent North Vietnamese takeover of the South, the harbors of Danang and Cam Ranh Bay, which U.S. forces developed.

TABLE 18

Atlantic Ocean Operations, 1964-1976

Period	Force Levels	Force Mix	Force Activity	Force Location
Spring 1964 to summer 1968	Force levels low, except during twice-yearly exercise periods and occasional interfleet transfers.	Base force generally composed of *Golf-* and *Hotel*-class ballistic missile submarines, 2-3 intelligence collectors, and several hydrographic ships. No continuous surface combatant deployments; submarine deployments predominate during exercise periods.	Activity levels low, except during exercise periods; activity otherwise confined to ballistic-missile submarine and intelligence collector patrols, hydrographic surveying, occasional interfleet transfers, and occasional special naval research operations.	Exercise forces operate off North Cape and in Norwegian Sea; ballistic-missile submarine patrols in north central Atlantic; continuous intelligence collection patrols off naval bases on U.S. east coast, in the Gulf of Cadiz off Rota, Spain (from Feb 1964), and in the North Channel off Holy Loch, Scotland (from Jul 1965).
Summer 1968 to summer 1969	Base force levels remain low; scale of exercises, however, much larger (involving more than 82 combatants, for example, Exercise Sever (Jul 1968) is more than twice as large as the previous spring's exercise).	Base force remains essentially unchanged; composition of exercise forces changes radically with numbers of surface combatants exceeding those of submarines by substantial margins.	Activity levels rise, primarily because of increase in scope and size of exercises and beginning in late 1968 of biannual transits of mass relief groups of conventional submarines between Northern Fleet and the Mediterranean.	Basic pattern continues.
Summer 1969 to spring 1974	Base force levels rise; periodic highs become more frequent.	Permanent surface combatant force, composed of 1 amphibious ship and/or 1 destroyer type, established off West Africa Sep 1971; periodic deployments of surface combatants and submarines to Caribbean begun Jul 1969; periodic deployments of Tu-95D long-range reconnaissance aircraft overseas begin 1970 (to Cuba from Apr 1970, to Guinea from Jul 1973), escort/destroyer patrol initiated in approaches to Baltic Sea; intelligence collector force rises with deployments to English Channel; *Yankee*-class SSBNs begin Western Atlantic missile patrols in 1969.	Activity levels continue to rise, owing to deployments to Caribbean and West Africa, and to increasing scope and size of Norwegian Sea exercises, culminating in *Okean* (Apr 1970). Mass conventional submarine transits every ten months replace earlier biannual cycle in Oct 1973.	Periodic operations in Caribbean, intermittent operations off West Africa from Dec 1970, permanent presence established Sep 1971, seasonal (Apr-Oct) patrol established in Skaw area in 1970; periodic intelligence collector patrols in English Channel from Dec 1970; scope of aerial reconnaissance coverage expands to central, southern, and western Atlantic; western Atlantic added to SSBN patrol areas.
Spring 1974 to end 1976	Basic pattern continues.	*Delta*-class SSBN patrols begin 1974, *Hotel-* and *Golf*-class SSB(N) patrols cease, basic pattern otherwise continues.	Mass transits of conventional submarines to and from Mediterranean resume Aug 1974; activity levels in central and southern Atlantic rise; aerial reconnaissance activity over western northern and south-central Atlantic increases.	SSBN patrol areas expand to include Greenland and Norwegian Seas; periodic operations in Gulf of Guinea and south-east Atlantic begin 1975; exercise area expands includes central and eastern Atlantic (*Okean*-75).

TABLE 19

Mediterranean Operations, 1965-1976

Period	Force Levels	Force Mix	Force Activity	Force Location
1964 to summer 1967	Force levels low; show erratic short-term variations, tending toward very low levels in winter months.	Force generally composed of diesel-powered attack submarines, destroyers and smaller units, with occasional deployments of a cruiser. Submarines far outnumber major surface combatants, though no cruise-missile submarines are deployed.	Activity levels usually low, with most surface ships in port or at anchor; infrequent small-scale exercises. Squadron completely self-sufficient. Sporadic surveillance of Western naval forces. Diesel-attack submarine deployments generally last no longer than three months each, with units relieved individually at the end of their deployments.	Force operates mostly in eastern Mediterranean, little or no activity west of Sicily. Force anchors off Kithira Island and in Gulf of Hammamet, Gulf of Sirte, Gulf of Sollum and just east of Crete. Submarines supported at those locations.
Summer 1967 to fall 1968	Force levels rise sharply after Six-Day War, grow slowly but steadily thereafter, pronounced seasonal highs and lows; force levels lowest during mid-winter and mid-summer.	Ratio of major surface combatants to submarines reverses, former now predominate. Regular cruise-missile submarine patrols begin Jun 1967. 3-unit contingent of amphibious ships established summer 1967, continuous presence of 1-2 mine-sweepers and 2-3 intelligence collectors begins. Support ships stationed at Alexandria from fall 1967; naval air unit established at Cairo West and Matruh airfields Apr 1968.	Sharp increase in activity levels in summer 1967 with later gradual decline as total number of units increases, strong seasonal variations. Continuous close surveillance ("tattletaling") by surface combatants or intelligence collectors of U.S. CVs operating in eastern Mediterranean from June 1967, aerial reconnaissance of U.S. units in eastern Mediterranean by Egypt based Tu-16s begins May 1968. Seasonal major exercise south of Crete.	Intelligence collector patrol established in Levant area after Six-Day War. Gulf of Sirte abandoned, significant increase in use of Hammamet, West of Melilla and Chella bank anchorages in 1968. Continuous combatant early warning patrols established in Alboran Basin and near Straits of Sicily Apr 1968. Alexandria used heavily for upkeep of diesel submarines and surface combatants after Mar 1968, amphibious [illegible] stationed in Port Said
Fall 1968 to winter 1970/1961	Force levels continue steady rise; seasonal variations continue as before.	First *Moskva*-class CHG deploys Sep 1968, peak surface combatant force levels reached when it is present in spring and fall. Regular dual patrols of cruise-missile submarines from early 1969. Proportion of force consisting of missile ships rises sharply in 1970.	Cycle of 5-month deployments of diesel-attack submarines, with mass relief of units at deployment end, established Aug 1969. Downward trend in activity levels reverses by end of 1970, total miles steamed up 86% from 1968.	Continuous presence in Mersa Matruh from Aug 1970 for upkeep of diesel submarines and surface combatants. Basic pattern otherwise continues.

TABLE 19
(Continued)

Period	Force Levels	Force Mix	Force Activity	Force Location
Winter 1970/1971 to summer 1972	Force levels stabilize, begin slight decrease in 1972; force levels continue to fluctuate but no longer show marked seasonal variations of earlier years.	Basic pattern continues, though presence of missile-armed ships declines slightly. Port Said-based LST deploys to West Africa Sep 1971, ending continuous presence of LST in Mediterranean amphibious group	Activity levels stabilize, show slight decrease in 1972; total days at anchor in 1972 up 8% from 1970.	Basic pattern continues.
Summer 1972 to fall 1973	Basic pattern continues	Ratio of major surface combatants to submarines changes sharply, latter again outnumber former owing to rise in number of diesel attack submarines. Naval air unit ousted from Egypt Jul 1972.	Activity levels continue overall decrease; naval air surveillance of Western units in Mediterranean ends Jul 1972. Size of diesel submarine turnover groups increases.	Soviet presence at Mersa Matruh ended Jul 1972. Intermittent intelligence collector patrol established off Athens Aug 1972 following homeporting of U.S. ships at Piraeus. Overhaul and refit of diesel submarines at Alexandria's Al Gabbari shipyard starts Jun 1972.
Fall 1973 to spring 1975	Force levels rise sharply during October War, decline thereafter to level somewhat higher than that of 1972.	Diesel attack submarine force levels rise appreciably increasing the overall numerical predominance of submarines over major surface combatants. Support ships stationed at Tartus, Syria from spring 1974	Activity levels continue overall decrease following October War surge; anchorage days in 1975 up nearly 10% from 1973. Ten-month mass-deployment cycle of diesel-attack submarines replaces earlier 5-month cycle in Oct 1973.	Amphibious group abandons Port Said Oct 1973; moves to Mersa Matruh, unoccupied since 1972. Soviet diesel submarines begin making regular use of Tartus for upkeep (spring 1974) and of Tivat, Yugoslavia for overhaul (Dec 1974). Basic pattern otherwise continues
Spring 1975 to end 1976	Force levels begin decline in mid-1975, reaching by the end of 1976 the lowest level since 1969.	Diesel attack submarine force declines in mid-1976. Intelligence collector force reduced with termination of Levant patrol in early 1976.	Basic pattern continues; fewer deployments to Mediterranean by Northern and Baltic Sea Fleet ships.	Soviets expelled from Mersa Matruh and Gulf of Sollum by Egyptians Jun 1975. Matruh amphibious group moves to northeastern Mediterranean, operates from Tartus and from anchorages near Cyprus. Soviets establish new anchorage north of Sollum, just outside Egyptian 22-mile limit. Soviets expelled from Alexandria Apr 1976; move support components to Tartus. Levant area intelligence collector patrol terminated early 1976.

TABLE 20

Indian Ocean Operations, 1968-1976

Period	Force Levels	Force Mix	Force Activity	Force Location
Spring 1968 to fall 1969	Deployments begin; force levels show marked seasonal variation.	Force generally composed of 1-2 SSM-armed surface combatants and 1 SAM- or gun-armed destroyer; gun-armed cruiser occasionally present; *Foxtrot*-class attack submarines deploy in winter months from Oct 1968; presence of POL ships intermittent.	Activity levels low; very little or no shore support; deployments average four months in duration.	Forces widely dispersed.
Fall 1969 to summer 1970	Force levels rise; seasonal variations continue; force also intermittently augmented by units transiting from Soviet Western fleets via Cape of Good Hope to Pacific Fleet.	Amphibious ship deployments begin Sep 1969; SSM-armed submarines begin periodic deployments same month.	Basic pattern continues.	Activity becomes concentrated in northwest quadrant of Indian Ocean, primarily off Socotra Island and Cape Guardafui.
Summer 1970 to fall 1972	Basic pattern continues.	Near-continuous SSM-armed surface combatant deployments end Jul 1970; continuous T-58 minesweeper deployments begin Oct 1970, reconnaissance overflights by USSR-based aircraft begin 1970. POL ship presence becomes continuous.	Basic pattern continues, SSM-armed submarine deployments now keyed to U.S. aircraft carrier deployments to area.	Basic pattern continues with heavy use of anchorages near Seychelles and Diego Garcia during Indo-Pakistani War.
Fall 1972 to winter 1973/1974	Seasonal variations end; force levels stable except during U.S. aircraft carrier deployments, when force is augmented by cruise-missile submarines.	*Vyn*-class barracks and repair ship arrives Berbera Oct 1972; continuous *Foxtrot*-class submarine deployments begin spring 1973; continuous *Petya*-class escort ship deployments begin Mar 1973.	Major expansion of Berbera facilities begins late 1972; significantly greater shore support provided; average length of deployments more than doubles to 8-9 months each, while basic activity level remains low.	Basic pattern continues as in 1969-1970.
Winter 1973/1974 to end 1976	Basic pattern continues; force now usually includes 1-3 units from Soviet Western fleets which, having transited the Suez Canal, operate in Indian Ocean for 4-5 months before ultimately transferring to Pacific Fleet.	Near-continuous *Amur*-class repair ship deployments begin Feb 1974; 8,500 ton floating drydock arrives Berbera Dec 1975; Il-38 ASW aircraft begin deploying to Somalia Apr 1975; Tu-95Ds follow in Oct 1976; periodic intelligence collector deployments being May 1974[b] *Vyn*-class barracks ship returns to Vladivostok Oct/Nov 1976.	*Amur*-class repair ship in Berbera almost continuously since Feb 1974; aerial reconnaissance and ASW activity increases; logistic support occasionally provided by Black Sea fleet units passing through Suez Canal from Jun 1975.	Minor combatant or intelligence collector assumes patrol in Straits of Hormuz May 1974; intermittent surface combatant presence established 1975 off southeast African littoral.

[a]Does not include activities of units deployed to Bangladesh and the Gulf of Suez for mineclearing and salvage operations. See Chapter III.

[b]An AGI had briefly deployed during the Indo-Pakistani War.

TABLE 21

Pacific Ocean Operations, 1965-1976

Period	Force Levels	Force Mix	Force Activity	Force Location
1964 to end 1965	Force levels low year-round.	Force normally composed of 1 escort ship, 1-2 minesweepers, 1-2 intelligence collectors, an occasional auxiliary, and *Golf-* and/or *Hotel-*class ballistic missile submarines. Missile-armed surface combatants, amphibious ships, and attack- and cruise-missile submarines rarely appear out of area.	Acitvity levels very low, primarily intelligence-collection, early-warning, and ballistic-missile submarine patrols. No significant out-of-area exercise activity. Transiting U.S. CVs periodically overflown by Long Range Aviation Tu-95s and Mya-4s.	Minesweepers and escort ships stationed at entrances to Sea of Japan (La Perouse, Tsugaru and Tsushima straits); intelligence collectors stationed off Guam (from Nov 1964), in Gulf of Tonkin (from Jan 1965) and (intermittently) off U.S. West Coast and Hawaii (from 1963). Ballistic-missile submarine patrols in north central and northeast Pacific from 1964
Early 1966 to spring 1968	Small increase in force levels; basic pattern otherwise continues.	Submarine force levels rise with establishment in 1966 of patrol in Philippine Sea manned alternately by a cruise-missile and attack submarine. Ocean rescue tugs begin deploying to Philippine Sea and Northeast Pacific submarine operating areas. Intelligence collector force rises with onset of East China Sea patrol in 1967. Surface combatants absent except during exercise periods.	Soviet Naval Aviation Tu-95Ds begin overflying transiting U.S. CVs; basic pattern otherwise continues.	Philippine Sea becomes regular submarine operating area in 1966; intelligence-collection patrol in East China Sea from 1967.
Spring 1968 to spring 1970	Force levels continue increase; begin to fluctuate with onset of transit activity from Vladivostok to Indian Ocean Mar 1968.	Transiting submarines, fleet auxiliaries, minor surface combatants, and missile- and gun-armed major surface combatants intermittently augment force for brief periods from Mar 1968. Basic force mix otherwise remains the same.	Transit activity rises with onset of deployments to Indian Ocean; basic pattern otherwise continues.	Anchorage established west of Pagan Island (Marianas) Sep 1969; basic pattern otherwise continues.
Spring 1970 to winter 1972/1973	Force levels continue steady rise until end 1971, stabilize at 17-20 ships thereafter. Fluctuations continue; size of out-of-area exercise force increases sharply beginning Apr 1970 with *Okean*.	Yankee SSBN patrols in northeast Pacific begin Oct 1970; regular out-of-area patrols by first-generation (*Golf-* and *Hotel-*class) ballistic-missile submarines discontinued early 1971. Basic pattern otherwise continues.	Out-of-area exercise activity shows sharp rise in 1970 with *Okean*, when Pacific Fleet forces participate in coordinated world-wide exercise for first time. Transit activity continues at heightened level as before.	Philippine Sea and northern Pacific intensely used during exercise periods. Intelligence collection patrol established near Kwajalein Island 1970. Basic pattern continues.
Winter 1972/1973 to end 1976	Basic pattern continues.	Philippine Sea submarine patrol discontinued early 1973; *Delta* SSBN patrols believed to have begun late 1975 or early 1976; previous pattern otherwise continues.	Basic pattern continues.	Gulf of Tonkin intelligence collection patrol moves to eastern South China Sea; basic pattern otherwise continues.

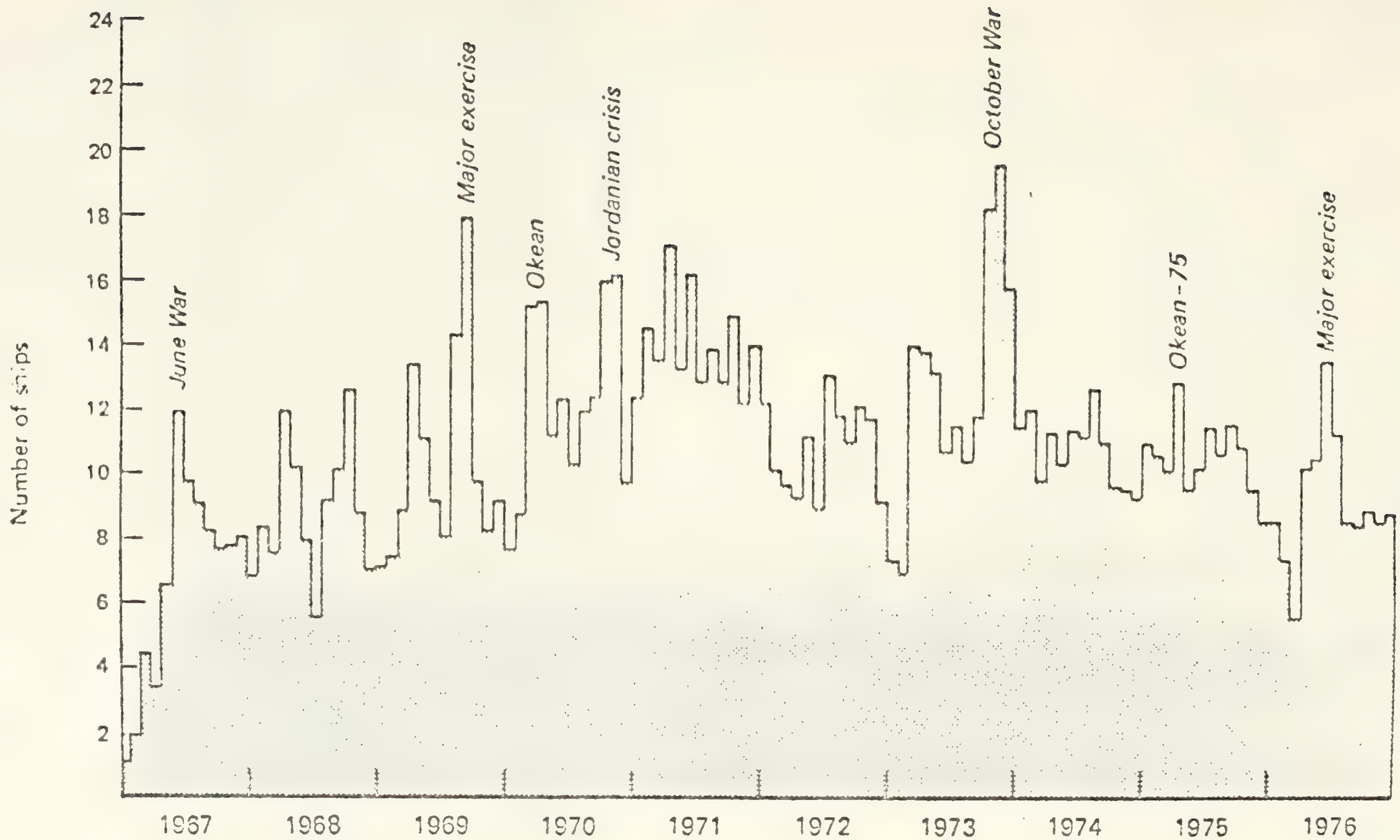

Fig. 17. Major Surface Combatant Force Levels in the Mediterranean (by Month), 1967-1976

TABLE 22

Mass Diesel Attack Deployments
to the Mediterranean, 1968-1976

Deployment Group	Arrival In Mediterranean	Interval Between Deployments	Support
1	Oct 1968-Jan 1969		Generally at sea from tenders and afloat in Alexandria.
		3-7 months	
2	Apr-May 1969		
		4 months	
3	Sep 1969		
		5 months	
4	Feb 1970		
		4 months	
5	Jun 1970		
		5 months	
6	Nov 1970		
		4 months	
7	Mar 1971		
		5 months	
8	Aug 1971		
		5 months	
9	Jan 1972		
		4 months	
10	May 1972		Submarines begin use of Al-Gabbari shipyard for major overhauls in June 1972.
		6 months	
11	Nov 1972		
		5 months	
12	Apr 1973		
		7 months	
13	Oct 1973		Submarines from the 13th deployment group initiate regular use of Syrian ports for upkeep.
		10 months	
14	Sep 1974		
		10 months	
15	Jul 1975		
		10 months	
16	May 1976		

TABLE 23

Mean Length of Deployment in the Indian Ocean (in Months), 1968-1975[a]

Year Deployment Began	Major Surface Combatants[b]	Amphibious Ships	Mine-Sweepers	Submarines	Auxiliaries[c]
1968	4	--	--	6	4
1969	5	4	--	4	5
1970	3	5	4	3	2
1971	5	5	4	4	4
1972	5	4	5	4	3
1973	10	12	11	5[d]	14
1974	7	13	11	4	7
1975	8	4	9	6	5

[a]Data for 1976 not available.

[b]Including escort ships.

[c]Excluding space operations support ships.

[d]Intermittent presence becomes continuous.

Fig. 18. Intelligence Collection Ship Patrols
Off U.S. SSBN Bases Since 1961

Fig. 19. Gatekeeper Patrols in
World's Choke Points

Naval Aviation

The Soviet naval air arm is also active on a regular basis over the world's oceans. Up until 1968, areas in the northeast Atlantic and northwest Pacific were the ones that were primarily vulnerable to reconnaissance flights from the Soviet land mass by the long range TU-95 BEARs. In April of that year, six TU-16 bombers were deployed to Egypt and they maintained a squadron there until asked to leave by the Egyptians in 1972. Four BE-12 MAIL ASW aircraft had reinforced the squadron in the interim and then these were replaced by the more advanced IL-38 MAYs. The principal object of the operations of these aircraft during that two year period was the U.S. Sixth Fleet. Table 24 and Figs. 20 and 21 depict other deployments by Soviet Naval Aviation and illustrate the coverage that the reconnaissance aircraft enjoy from their overseas bases.[84]

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[84] Petersen, "Trends in Soviet Naval Operations", in Soviet Naval Diplomacy, pp. 57 - 59.

TABLE 24

Overseas Deployments by Soviet Naval Aviation
April 1970 - April 1977

Country	Date of First Deployment	Number of Deployments	Type of Aircraft Deployed
Cuba	April 1970	29	Tu-95D
Guinea	July 1973	19	Tu-95D
Somalia	April 1975	8	Il-38
	October 1976	1	Tu-95D
South Yemen	April 1975	1	An-12
Angola	February 1977	1	Tu-95D

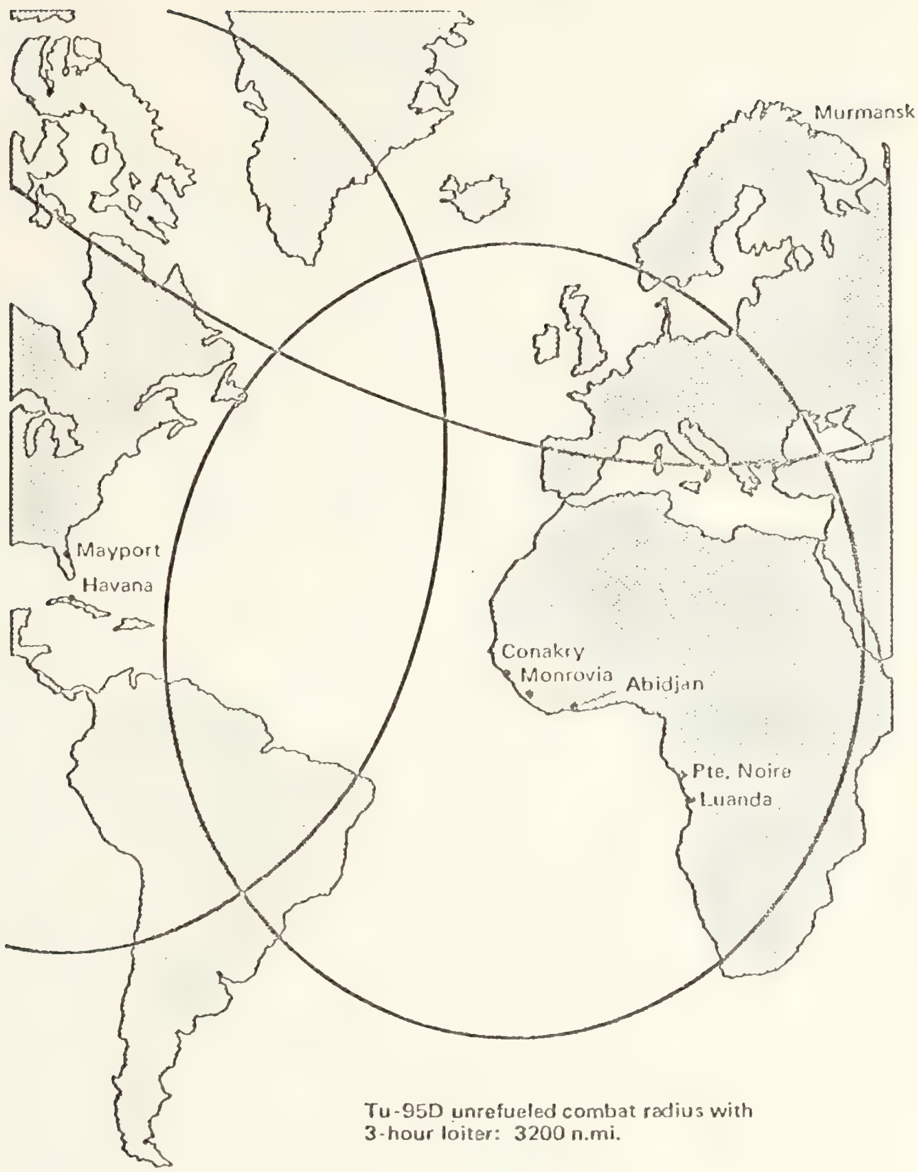

Fig. 20. TU-95D Coverage of Atlantic Ocean

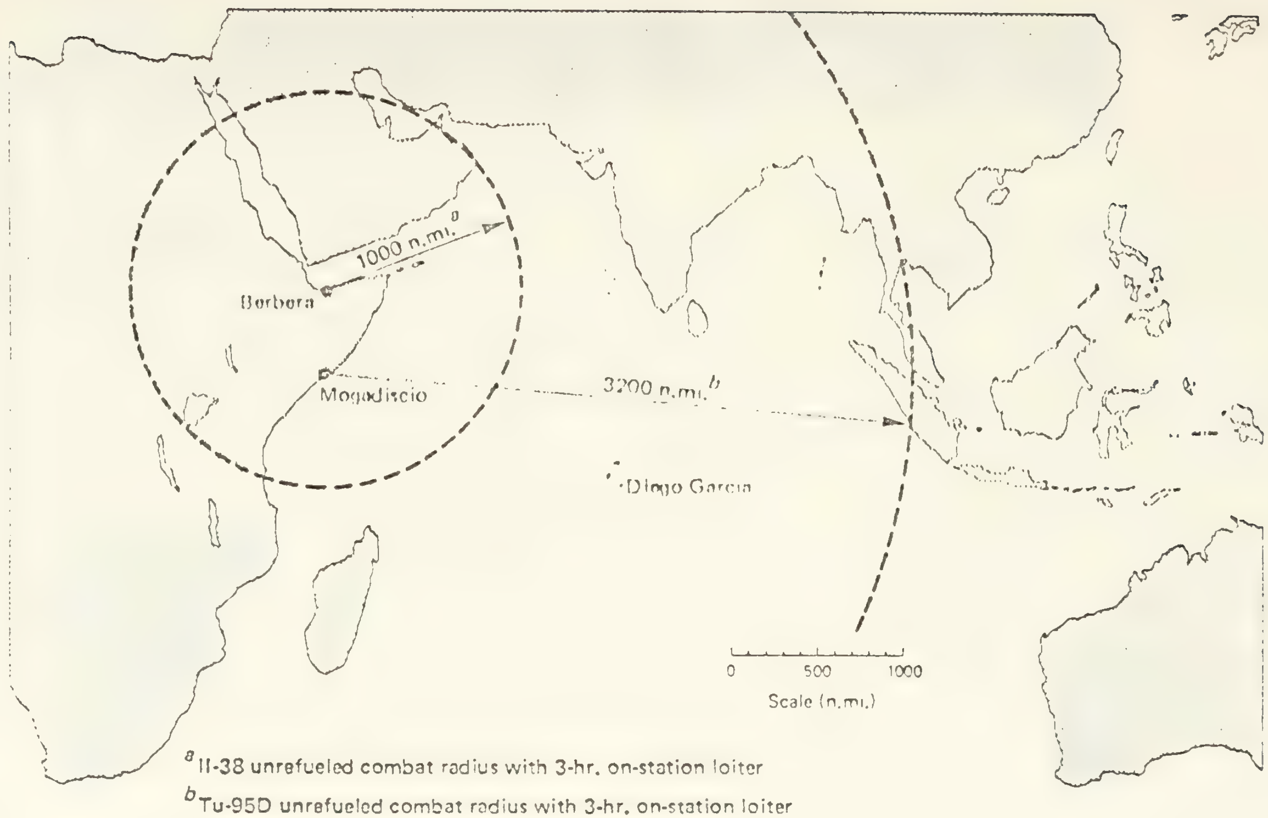

Fig. 21. Reconnaissance Aircraft Coverage of Indian Ocean

Logistics support activities

Gorshkov talked not only of disposing his forces in the various ocean theaters, but also of providing facilities in the sea, the proper organization of forces and a base system appropriate to their mission.[85] It is perhaps in the area of logistics support to deployed forces that the Soviet Navy has yet to reach the standards of other modern navies. Table 25 provides a comparison of the displacement and capacity of U.S. and Soviet oilers.[86] As noted in the table, all except the SOFIYA class are considerably smaller than U.S. counterparts. Only the DUBNA and BORIS CHILIKIN classes are capable of providing dry stores in addition to fuel. Because most Soviet combatants can not make fresh water on board for drinking, provision of this necessity is also a must from the support force. Due to the limited size of the oilers, this results in opportunity costs as fuel is displaced by the fresh water requirement. Further, most replenishment must take place at anchorage vice underway at sea due to the limited capabilities of the auxiliaries to supply and the combatantants to receive stores and fuel underway.

While these deficiencies are being overcome as more modern units become available, up into the 1980s the

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[85] See page 148.

[86] Petersen, "Trends in Soviet Naval Operations" in Soviet Naval Diplomacy, p. 62.

Soviets have relied upon an extensive anchorage system and access to overseas port facilities to compensate for these difficulties. Figs. 22 and 23 portray the anchorages regularly used by the Soviets in the Mediterranean and the Indian Ocean respectively. Table 26 outlines the countries, degree of access and types of services performed for the Soviets at port facilities around the world.[87] Not mentioned on this table are the base in Cuba at Cienfuegos and the ports of Danang and Cam Ranh Bay in Vietnam cited earlier. In addition to the regular use of facilities in the nations above, Soviet port visit activity throughout the world has grown extensively since 1967 as indicated in Table 27.[88] Surface combatants and submarines normally make few purchases during these visits. Their purpose is primarily for crew rest, limited maintenance and showing the flag. As cited earlier, the merchant fleet makes the bulk of the purchases for the Soviet Navy with resupply occurring later at an anchorage or while standing down in relatively calm waters at sea.[89]

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[87]Ibid., pp. 65, 66 and 70.

[88]Ibid., pp. 68 and 69.

[89]See page 155-156

TABLE 25

U.S. and Soviet Naval Oilers

Class	Full-Load Displacement	Fuel Capacity
U.S. Navy		
Neosho	39,800 tons	203,000 barrels
"Jumboized" T3-S2-A3	35,100 tons	180,000–192,000 barrels
"Jumboized" T3-S2-A1	36,500 tons	185,000 barrels
T3-S2-A1	25,200 tons	140,000 barrels
Sacremento	52,500 tons	204,000 barrels
Wichita	41,400 tons	165,000–172,000 barrels

(Average capacity: 186,000 barrels)

Class	Estimated Full-Load Displacement	Estimated Fuel Capacity
Soviet Navy		
Sofiya	62,600 tons	313,000 barrels
Altay	7,400 tons	37,200 barrels
Uda	7,115 tons	13,300 barrels
Olekma	6,690 tons	33,900 barrels
Pevek	6,690 tons	33,800 barrels
Kazbek	16,250 tons	66,300 barrels
Polyarnik	12,500 tons	37,300 barrels
Boris Chilikin	24,450 tons	132,100 barrels
Dubna	13,000 tons	52,500 barrels

(Average capacity: 63,500 barrels. Excluding the single unit of the *Sofiya* class – a converted merchant ship – average capacity is approximately 40,000 barrels.)

Fig. 22. Soviet Replenishment Anchorages in the Mediterranean

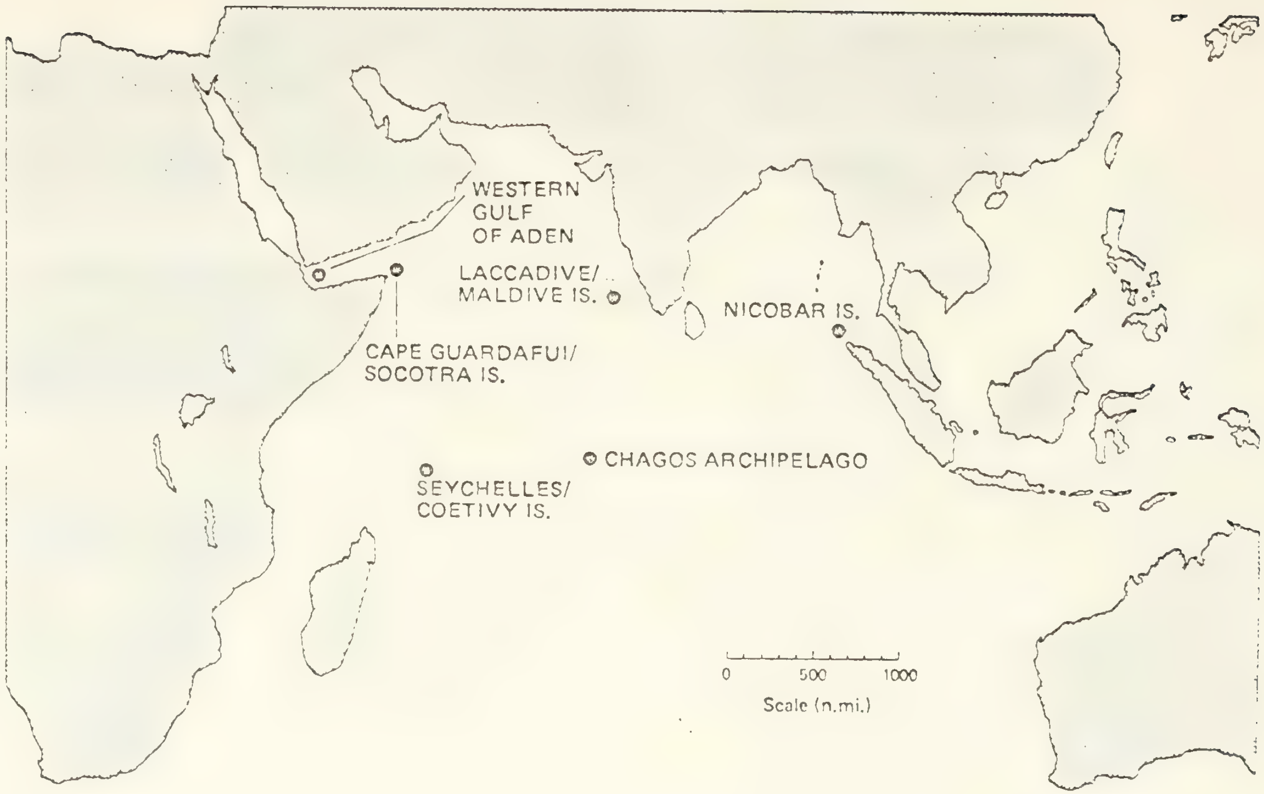

Fig. 23. Soviet Replenishment Anchorages in the Indian Ocean

TABLE 26

Soviet Operational Access to Overseas Ports and Naval Facilities

Countries	Type of Facilities to Which Soviets Have Had Access	Services Performed	Probable Terms of Access
Egypt, 1968-76, Somalia, 1972-1977 [b]	Soviet-controlled shore facilities, permanent stationing of Soviet support ships in harbors	Assisted repairs,[a] replenishment, crew rest ashore	Non-commercial, unrestricted operational visiting rights.
Syria, 1973-	Quasi-permanent stationing of Soviet support ships in harbors	Assisted repairs,[a] replenishment.	Non-commercial, unrestricted operational visiting rights
Algeria, 1976-, Syria, 1968-73	Occasional stationing of Soviet support ships in harbors	Assisted repairs,[a] replenishment	Non-commercial, operational visiting rights, possibly with some host restrictions
South Yemen, 1969-, Guinea, 1971-, Algeria, 1967-76, Somalia, 1971-72, Iraq, 1973	None	Unassisted repairs,[c] replenishment	Non commercial, except for Algeria, unrestricted operational visiting rights
Yugoslavia, 1974-	Host-controlled shore facilities, occasional stationing of Soviet support ships in harbors	Assisted repairs, replenishment.	Quasi-commercial, restricted.
Singapore, 1968-	Host-controlled shore facilities.	Assisted repairs on naval auxiliaries; replenishment.	Commercial, competitive and restricted.
Spain, 1974-; Gibraltar, 1969-; Italy, 1970-.	None.	Replenishment of naval-associated merchant tankers.	Commercial, competitive.

[a]Repairs performed with the assistance of repair ships, tenders or shore facilities.
[b]Unrestricted access to Albania, 1958-1962, is discussed in appendix D
[c]Repairs performed without the assistance of repair ships, tenders or shore facilities.

TABLE 27

Soviet Operational Port Visits, 1967-1976

Country	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1967-1976
Egypt	16	162	77	36	201	62	87	292	242	65	1,240
Syria	14	38	17	19	14	37	28	41	66	87	361
Somalia	–		2	7	22	20	42	61	54	75	283
Guinea	–		5	4	23	52	36	28	27	48	223
Cuba[b]	–	–	–	21	22	45	22	48	31	25	214
Algeria	13	19	8	17	26	22	28	15	17	18	183
South Yemen	–	–	4	5	15	7	14	37	34	18	134
Singapore[c]		–	1	11	16	13	23	22	17	15	118
Spain[c]	–		–	–	–	3	–	14	20	34	71
Iraq	–		4	1	2	8	15	17	8	12	67
Yugoslavia	9	6	9	3	4	3	5	4	10	11	64
Gibraltar (UK)[c]	–		2	2	10	5	14	9	10	2	54
Italy[c]	–	–	2	3	2	–	–	4	18	19	48
Morocco			3	3	1	2	8	12	4	2	35
Sri Lanka	–	1	2	1	–	6	2	5	6	6	29
Mauritius			1	7	1	9	1	2	2	1	24
India	–	–	1	6	2		3	2	4	2	20
Senegal	–	–	2	3	3	6	1	–	1	3	19
Tunisia		–			–	–	–	4	1	12	17
Kenya	–		1	4		–	2	4	1	–	12
Equatorial Guinea			–	3	–	3	–	5	–	–	11
Sierra Leone	–	1	–	–	1		1	4	1	3	11
Brazil				5	–	4	–	–	–	–	9
North Yemen	–		1	2	–	–	–	1	2	3	9
Greece	–	–			–	2	–	–	–	6	8
Nigeria			4	3		–	–	–	–	1	8
Pakistan	–	–	5	2		–	–	–	1	–	8
France	–	–		3		–	3	–	1	1	8
Mexico	–	–	–		–	4	–	1	1	2	8
St. Helena (UK)				4	1	–	–	–	–	–	5
Uruguay	–	–		3	2	–	–	–	–	–	5
Congo (Brazzaville)	–		–	–	–	3	–	–	1	1	5
Maldives	–			–	3	–	–	–	1	1	5
Canada	–	–		1			–	–	–	4	5
Bermuda (UK)	–		–	–	–	–	–	2	2	–	4
Sweden	–	–	–	–	–	–	–	1	1	1	3
Libya			2	1	–	–	–	–	–	–	3
Barbados	–	–	3	–	–	–	–	–	–	–	3
Ireland	–	–			–	–	–	–	3	–	3
Falkland Is. (UK)	–	–				3	–	–	–	–	3
Iran	–		2		–	–	–	–	–	1	3
Western Samoa	–	–			–	–	3	–	–	–	3
Turkey	–			–	–		–	1	–	1	2
United Kingdom	2						–	–	–	–	2
Angola		–		–	–	–	–	–	–	2	2
Tanzania				2		–	–	–	–	–	2
Japan				2	–	–	–	–	–	–	2
New Zealand			–	–	1		1	–	–	–	2
New Caledonia (Fr.)			–	2			–	–	–	–	2
Cyprus							–	–	–	1	1
Norway		–			1	–		–	–	–	1
Denmark								–	–	1	1

TABLE 27

(Continued)

Country	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1967-1976
Liberia	–	–	–	–	-	–	–	–	–	1	1
Ethiopia	–	–	1	–	–	–		–	–	-	1
Kuwait	–	–	1	–	–	–	–	–	-	–	1
Madagascar	–	–	1	–	–	–	-	–	–	–	1
Seychelles[d]	1	–	–	–	-	–	–	–	–	-	1
Sudan	–	–	–	1	–	–	–	–	–	–	1
Fiji	–	–	–	–	1	-	–	–	–	–	1
Peru	–	-		–	-	-	-	1	–	–	1
United States	-	–	–	–	–		-	1	-	–	1
Total	55	227	161	187	374	319	339	638	587	485	3,372

[a]Excluding visits by oceanographic research ships and space support ships. Values believed to be representative, possibly incomplete.

[b]Communist state; not treated further in this discussion

[c]No operational visits by combatants

[d]U.K. colony until June 1976.

Table 28 denotes the location to which Soviet aircraft have deployed since 1968.[90] Not shown are Cairo, Egypt, which was the only location to have a regularly assigned squadron (1970 - 1972), Aden, South Yemen and Danang in Vietnam. Aden has been the principal field in the Indian Ocean area since the Somalians withdrew their hospitality after the Soviets sided with Ethiopia in the hostilities between those two nations. Fuel is usually the only local purchase for these deployments. Spare parts, light repair equipment, maintenance and extra flight crews are normally brought in by accompanying transport aircraft.

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[90] Petersen, "Trends in Soviet Naval Operations", in Soviet Naval Diplomacy, p. 75.

TABLE 28

Overseas Airfields From Which Soviet Naval Aviation Has Operated

Country	Airfield Name	Location	Length[a]
Somalia	Hargeisa International	09-30N/44-06E	7,500
Somalia	Berbera Military Airfield	10-24N/44-56E	13,500
Somalia	Dafet Air Base	02-39N/44-47E	10,000
Cuba	José Martí International	22-59N/82-24W	12,000
Guinea	Conakry Airport	09-35N/13-37W	11,000
Angola	Luanda Airport	08-51S/12-15E	12,000

[a]Length of primary runway, in feet.

Trends in out-of-area operations

While deployed, the Soviet Navy regularly exercises its naval warfare capabilities. In addition to port visits to show the flag and exercise operations, the Navy also has been actively engaged in incidents of coercive diplomacy since 1967. Twenty of these incidents are documented in Table 29.[91]

Since 1966, there have been four major superpower naval confrontations: The June 1967 Arab-Israeli War, the Jordanian Crisis of September 1970, the December 1971 Indo-Pakistani Crisis, and the October 1973 Arab-Israeli War.[92] The conclusion reached by the author's studying of these confrontations was as follows:

> "By 1963 the Soviets had developed the capability to use their Navy to try to influence both the course of an international crisis and the behavior of the U.S. toward that crisis. Events have shown that under the proper circumstances Soviet Crisis-management forces possess antiship capabilities that require the serious attention of U.S. leaders in their crisis deliberations. In addition, the Soviet Fleet has shown that it can simultaneously carry out

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[91] Abram N. Shulski, ed., "Coercive Diplomacy", in Soviet Naval Diplomacy, pp. 116, 117.

[92] These confrontations are examined in detail in Stephen S. Roberts, ed., "Superpower Naval Confrontations", in Soviet Naval Diplomacy, pp. 158 - 220. (Author's note: The blockade during the Cuban Missile Crisis in 1962 discussed in Chapter I involved a confrontation between powerful U.S. ships of the line and essentially unarmed Soviet merchantment. Although there was a potential for a submarine threat, Soviet submarines that may have been in the area did not intervene overtly.)

> limited operations that might have a direct impact upon the crisis ashore."[93]

Since 1979 and the taking of the hostages in Iran coupled with the Soviet invasion of Afghanistan, the Soviet Tenth Eskadra and the U.S. Battlegroups operating in the Indian Ocean have stood eyeball to eyeball as the events continue to unfold. Although the leadership of both nations have been exceedingly circumspect in their management of naval activities in all these crises, the potential for escalation remains as the respective forces are maintained at the ready.

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[93]Ibid., p. 213.

TABLE 29

Incidents of Coercive Diplomacy

Date	Place	Episode	Significance
May-Jun 67	Eastern Mediterranean Sea	*June War* - Surge deployment of 2 cruisers, 8 destroyers, and submarines to Mediterranean; threatened intervention with Airborne Troops at peak of crisis.[b]	First major political use of the fleet; significant risk of the fleet in area of major U.S. deployment
Jul-Sep and Oct 67	Port Said and Alexandria	*Aftermath of June War* - Soviet combatants led by a cruiser in Port Said and Alexandria; combatants return following Israeli shelling of Port Suez in reprisal for sinking Israeli destroyer *Elat*	Demonstration that commitment to Egypt extended to risk of Soviet combat force
Jan-Feb 68	Sea of Japan	*Pueblo incident* - Deployment of cruisers and destroyers into Sea of Japan in response to U.S. naval concentration	Use of Navy to show willingness to defend "client" against U.S. pressure and possible attack
Jul 68	Norwegian Sea	*Exercise Sever* - Major naval concentrations in the Baltic and in the Norwegian Sea	Demonstration of willingness and ability to counter a Western naval response to the August invasion of Czechoslovakia
Feb-Mar 69	Gulf of Guinea	*Ghanaian incident* - Small naval squadron off Accra during Soviet-Ghanaian negotiations on release of detained Soviet trawlers and crews	Use of Navy to defend Soviet lives and property
Apr 69	Sea of Japan	*EC-121 incident* - Two destroyers in Sea of Japan assist U.S. in search for U.S. intelligence plane shot down by North Korea. Small-scale deployment of surface ships in response to major U.S. naval concentration in Sea of Japan	Use of Navy both to demonstrate disapproval of North Korean action and also to limit level of U.S. response
Dec 69	Somali ports, northwestern Arabian Sea	*Somali port visits* - Soviet ships perform a series of port visits and steam steadily off Somalia following assassination of the president and a bloodless military coup	Demonstration of support for favored faction in Somali internal affairs
Apr-May 70	Somali ports	*Extended Somali port visits* - Long and multiple visits in Somali ports when Somalia reportedly felt threatened by domestic rebellion supported by Ethiopia	Support for favored faction in Somali internal affairs
Jul 69-Apr 74	Cuban ports	*Submarine deployments to Cuba* - Nuclear and diesel powered attack submarines, submarine tenders deployed to Cuban ports; construction of submarine service facility at Cienfuegos; deployment of G-II diesel powered ballistic missile submarines to Cuba (April 1972 and April 1974)[c]	Support for Soviet positions in SALT negotiations; demonstrations of support for Cuban regime; possible test of U.S. will to enforce understanding reached following Cuban missile crisis
Sep-Oct 70	Eastern Mediterranean Sea	*Jordanian crisis* - Increased deployments into Mediterranean; ACW groups formed.[b]	Use of fleet to inhibit U.S. freedom of action

TABLE 29

(Continued)

Date	Place	Episode	Significance
Dec 70–present	East Atlantic Ocean	*West Africa Patrol*. Almost continuous patrol by Soviet combatants along West African coast and in Conakry following Portuguese attack (22 November 1970) on Guinea. Significant presence by amphibious ship since January 1972	Support for friendly government; active surveillance and possible counter-incursion barrier; protection of Conakry-based insurgents in Portuguese Guinea (Bissau)
May 71	Freetown, Sierra Leone	*Sierra Leone port visit*. Destroyer visits Freetown during a period of domestic instability	Support for favored leader in Sierra Leone
Dec 71	Bay of Bengal, central Indian Ocean	*Indo-Pakistani crisis*. Deployment of 2 anticarrier task groups to the Bay of Bengal to counter presence of *Enterprise* task force[b]	Demonstration of Soviet support for India and desire to inhibit U.S. freedom of action
May–Jun 72	South China Sea	*U.S. Mining of Haiphong*. Deployment of surface squadron and submarines to South China Sea in reaction to U.S. mining of North Vietnamese coastal waters	Symbolic expression of Soviet concern with safety of its merchant ships and continued support for North Vietnam
Spring 73	Norwegian Sea	*Cod War*. Large-scale naval exercise in the Norwegian Sea at the peak of the U.K.-Iceland dispute over fishing rights[c]	Possible attempt to symbolize Soviet support for Iceland's position
Apr–Jul 73	Mediterranean Sea	*Sealift of Moroccan troops to Syria*. Possible convoy operations	Protection of assets at sea; reflected concern with possible Israeli counteraction
Summer 73	Arabian Sea	*Support of South Yemen regime*. [illegible]	Protection of assets at sea; indirect material support for insurgency in Dhofar province, Oman
Oct–Nov 73	Eastern Mediterranean Sea	*October War*. Major fleet augmentation threatening Soviet intervention at the peaks of the crisis; augmentation in the Indian Ocean in war's aftermath[b]	Use of fleet to inhibit U.S. Sixth Fleet in Mediterranean support of Israel and security of military supplies during the war; support possible airlift of Soviet troops to Egypt or Syria
Nov 74	Eastern Mediterranean Sea	*Port visit to Latakia, Syria*	Demonstration of Soviet support for a client threatened by Israel, and support for Syria's delay in approving an extension of the U.N. Syrian peacekeeping mandate
Nov 75–Feb 76	Southeastern and central Atlantic Ocean	*Angola crisis deployments*. Combatants deployed off Congolese coast in connection with sealift of military supplies to MPLA; probable nucleus of ASW group deployed to operating area on direct sea route between U.S. and Angola	Protection of military supply to favored faction in Angolan civil war; early warning of possible U.S. deployments to Angolan waters; possible attempt to discourage such U.S. deployment

[a] In Chapter 7 some of these episodes have been variously consolidated or further subdivided in order to generalize about Soviet behavior.

[b] These episodes are detailed in chapter 5.

[c] These episodes are detailed in appendix C.

Trends in out-of-area exercises

The largest scale exercises ever conducted by the Soviet Navy out-of-area were what are known in the West as the Okean series, the first in 1970 and the second in 1975. World wide in scope, both these exercises included over 200 participating units and they were orchestrated from Naval Headquarters in Moscow. Fig. 24 depicts the area to which the participating units deployed for the 1975 version.[94] Still other exercises less well known have been conducted locally by the Soviets in the Mediterranean, and the Indian Ocean.

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[94]Primary source: Bruce W. Watson and Marguerite A. Walton, "Okean-75", U.S. Naval Institute Proceedings, July 1976, p. 95, as extracted from Petersen, "Showing the Flag", in Soviet Naval Diplomacy, p. 75. (Author's note: That an Okean scale exercise did not materialize to the extent anticipated in 1980 may be attributed to the heightened tensions between the superpowers as an aftermath of the Iranian Hostage Crisis and the Afghanistan invasion. Despite the minimum exercise activity, Soviet out-of-area naval force levels remained high in the spring of 1980 due to these events.)

Fig. 24. OKEAN Exercise Areas

Professor Donald C. Daniel, who has taught a course titled "Soviet Naval and Maritime Strategy" at the Naval Postgraduate School since the early seventies, has discerned several trends with regard to the conduct of these exercises:[95] Beginning in 1965, the largest out-of-area exercises appear to be held every five years corresponding to the terminus of one five year plan and the commencement of the next. The exceptions include Exercise SEVER in 1968, which was a Warsaw Pact exercise with units of other bloc nations vice being strictly Soviet. Local exercises are held biannually by the four fleets normally in the spring and late summer or early fall.

From 1961 onward, Anticarrier Warfare (ACW) has been included as a principal scenario in most exercises. Through 1971, the Soviet practice of ACW emphasized primarily the strike phase. Beginning in 1974, an apparent shift in emphasis toward the reconnaissance and surveillance phase has been detected. This would include concentration on a "buildup of tensions" scenario with the employment of satellites included among the ocean surveillance assets used.

Antisubmarine Warfare (ASW) had been a feature of most exercises prior to 1973. In the spring of that year

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[95]Donald C. Daniel, "Trends and Patterns in Major Soviet Naval Exercises", in Naval Power in Soviet Policy, pp. 221-231.

it was made the major exercise theme and coordinated air, surface and submarine assets were employed against open ocean targets.

Soviet amphibious maneuvers have usually been conducted separately from major exercises. Evidence to date seems to indicate that the Naval Infantry, the Soviet counterpart to the Marine Corps, is considered to provide the spearhead of any landing operations with regular army ground forces following up, even being transported to the objective area in merchant ships if necessary. Other aspects of naval warfare practiced by the Soviets in these exercises have included interdiction of sea lines of communication, convoy operations and underway replenishment.

Professor Daniel concludes his article with the following remarks:

> "From an exercise point of view, Soviet progress in ACW is truly impressive, reflecting a very strong commitment. Progress in ASW is more difficult to gauge, but the exercises, particularly those in recent years, indicated that the Soviet commitment to the ASW problem is just as strong if not stronger than the commitment to ACW. Soviet progress in amphibious warfare is also difficult to judge, but in this writer's opinion, progress was especially marked in the sixties through the beginning of the seventies with the Soviets now possibly being on a plateau. The question of progress in the ANTI-SLOC mission may not be as important as the question of commitment to that mission since residual Soviet capability for strikes against SLOC exists. At-sea replenishment is, I believe, the Soviets achilles heel.

The Soviet commitment to improve the war-sustaining capability is there, but it does seem less strong than Soviet determination to improve their war-fighting posture. As for command and control, it is enough simply to note the following: any country which moved from a relatively small Norwegian Sea exercise in 1961 to worldwide 200 ship maneuvers in 1970 and 1975 must have made a strong commitment to improving C^2 and actually achieved significant results."[96]

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[96]Ibid., p. 231.

Conclusion

Situation in 1981

In early 1981, the Chief of Naval Operations, Admiral Thomas B. Hayward, testified before the Senate Armed Services Committee:

> "We have entered a period in which any reasonable estimate of the balance falls within the range of uncertainty. In other words, the situation today is so murky one cannot, with confidence, state that the U.S. possesses a margin of superiority."[97]

The CNO continued to point out that the U.S. naval capabilities improved throughout 1980, but the pace of development lagged behind that of the Soviets. He compared the commissioning of one U.S. attack nuclear submarine in 1980 to the commissioning of 12 attack submarines in the Soviet Union, eight of which were nuclear powered. He indicated that from a qualitative standpoint, Soviet naval development included launching the 22,000 ton KIROV class nuclear powered missile cruiser. The newest U.S. nuclear cruiser weighs only 11,000 tons. Further, the sophisticated air defense system for this cruiser that will be comparable to what KIROV carries today, will not be introduced into the U.S. fleet until 1982. With regard to submarine development; the OSCAR class introducted in 1980 is the largest cruise missile carrying submarine in the world, while the new TYPHOON class ballistic missile

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[97]"Navy Chief Details Loss of U.S. Edge on Soviets", Aviation Week & Space Technology, February 9, 1981, p. 35.

boat is the largest submarine ever built.

Projection to 2000

The following developments were highlighted during a symposium sponsored by the DNI, Rear Admiral Sumner Shapiro, in July 1980:[98]

> "...Current surface construction includes four ongoing cruiser programs...At least as many additional cruiser programs are anticipated by the end of the century. Two additional KIEV class carriers are expected to be launched before a new class of CVN becomes operational later in this decade. The IVAN ROGOV LST appears to be the beginning of building larger amphibious ships...When coupled with AO and CVN developments, this will dramatically improve the Soviet Navy's ability to project power..."

> "...Expanded Soviet shipyard capability will produce new classes of nuclear attack and cruise missile submarines, diesel attack submarines, and nuclear ballistic missile submarines...(the latter type), however, should represent a smaller percentage of submarine construction due to the Strategic Arms Limitations Agreements..."

> "...Aircraft production will see an increase in seaborne aircraft, with a fixed wing, catapult launched aircraft for the anticipated CVNs as well as an improved helicopter...BACKFIRE production is expected to continue through the decade, to be replaced in the 1990's...The BEAR will probably have a jet powered replacement by the late 1980's. Additionally, continued development of Wing-in-Ground Effect vehicles with subsequent series production is possible..."

> "...The future Soviet Navy will, therefore, have more air power, improved targeting and surveillance capabilities, coupled with longer range, more accurate missiles. It will also have fewer, although

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[98]Office of Naval Intelligence (ONI) presentation at the symposium on "The Soviet Navy as an Extension of Soviet National and Military Strategy"(U), ONI Naval Intelligence Newsletter, October 1980, pp. 14 - 21 (Classified Reference).

vastly more capable ships..."

"...Soviet weaknesses that will continue include geographic constraints, open-ocean ASW...,air defense, and the high rate of personnel turnover..."

"...It appears that the Soviet Navy has reached a watershed. If current trends continue this leads to the question. 'What will the Soviets do with this vastly more capable Navy?'..."

Application to the Naval Warfare Analysis Experiment

That Admiral Gorshkov already has achieved many of his objectives towards building a balanced navy cannot be denied. The evidence also indicates the substantial naval warfare capability that he has provided to Soviet decision makers and confirms their will to employ that capability aggressively in support of Soviet foreign and security policy. Now that the reality situation has been presented, Chapters IV and V will compare and test both the conceptual and scientific models they develop against this reality situation to determine the validity of these models for providing automatic data processing support to naval warfare analytical and managerial activities.

IV. THE CONCEPTUAL MODEL: NAVAL WARFARE ANALYTICAL AND INFORMATION MANAGEMENT THEORY

Purpose

This chapter addresses the problems related to the processing, analysis, production and management of intelligence concerning naval warfare activities. It applies the threat perception, crisis management, systems analysis, and management information system concepts described in Chapter I to develop naval warfare analytical and information management theory. It relates this theory to both intelligence requirements indicated as a result of the systems analysis conducted in Chapter II and the reality situation described in Chapter III concerning the potential threat posed by the dramatic expansion in Soviet naval capabilities and activities that has occurred since Admiral Gorshkov took the helm. The conceptual model developed in this manner provides the foundation for the detailed scientific models of automatic data processing support capabilities outlined in Chapter V. These support capabilites are offered as proposed solutions to the direction that the future development of OSIS should take in order to improve the ability of the naval intelligence

system to support naval decision making in response to the Soviet threat.

The chapter covers three major topics as follows: (1) Operational intelligence requirements. (2) Naval Warfare Analysis Experiment Overview. (3) Naval Warfare analytical and information management theory.

Operational Intelligence Requirements

Service to the Operational System

Chapter II noted that operational system components required technical intelligence products that assess how the adversary employs his material systems and capabilities operationally. These components required operational intelligence products that assess where the adversary has deployed his naval forces, what kinds of naval activity are these forces conducting, and what does the adversary intend to do next. These intelligence products were used by operational system components to justify naval programs, develop naval doctrine and strategy, formulate contingency and operational plans, exercise command and control functions, and to support naval tactical training and readiness exercises.[99]

Key Operational Intelligence Questions

These support requirements suggest that the operational

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[99] See discussion on p. 93-95.

intelligence process should focus on and seek answers to nine key questions related to the conduct of naval activity by potential adversaries. (1) Where are the adversary's forces? (2) What is their composition and which specific individual units do these forces include? (3) What are they doing? (4) What are their capabilities? (5) How do they exercise their capabilities? (6) How well can they conduct naval warfare? (7) Where are they going and what will they do next? (8) How will these activities affect U.S. forces? (9) Which U.S. units need to be advised?

Of these nine questions, the answers to one and two can be provided more easily than the remaining seven. Recent data from even one ocean surveillance sensor will assist resolution of the unit location and identification questions.

Question three requires tracking of the forces concerned over time at the minimum to provide even a semblance of an estimate of what these forces are doing. At least periodic observation of these activities would be required to confirm that estimate.

Initial estimate of individual unit capabilities can be derived once the units concerned have been identified through sensor data. Other sensor data might suggest that new capabilities have been provided these units. Visual observation and photography would provide confirmation of this.

Questions five through seven require the active collection and reporting of friendly units from the scene of the activity in order to assemble sufficient intelligence that will provide a reasonable assessment of the ramifications of that activity. Continuity on the problem concerned and familiarity with the various patterns of adversary activity help refine this activity assessment.[100]

The answers to questions eight and nine are the reasons for performing the operational intelligence process. They indicate the decisions that the commander needs to make prior to directing response to the situation. Intelligence analysts cannot assess the impact of adversary activity if they cannot relate it to the potential target of the activity and to the essential elements of information required by the commander they serve. To answer these questions, the intelligence analyst must have friendly force information on hand. Further, he must maintain sensitivity to the current needs of the commander and his key staff personnel.[101]

Naval Warfare Analysis Experiment Overview

The Naval Warfare Analysis Experiment is concerned

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[100] See discussion on pp. 111-114.

[101] See discussion of the tasking function on pp. 81 - 82, the consumption function on pp. 89 - 92, and the planning function on pp. 101 - 103.

with the development of automatic data processing capabilities that will assist formulating answers to the operational intelligence questions outlined above. It seeks to assist resolution of these questions both with regard to current operational activity conducted by potential adversaries and the long term trends and implications of adversary activity.

Project Goals

Specific goals of the project include the following:

(1) Developing and demonstrating the utility of a theory that defines naval warfare activities in terms of specific variables that can be processed and manipulated quantitatively.

(2) Demonstrating the utility of organizing and processing qualitative narrative data concerning naval warfare activities by dividing and storing narrative according to specific descriptive categories that apply to even the most complex naval activity.

(3) Designing and installing experimental automated files that will accept naval warfare data in the forms that it is currently provided to OSIS and permit it to be processed and manipulated both quantitatively and qualitatively in the terms described above.

(4) Demonstrating the utility that such information capabilities would provide to the naval warfare analytical and information management processes.

Intelligence Problems Addressed by the Project

Processing

Project research has explored the following problems with regard to the processing segment of the intelligence

cycle: (1) Organization of the data base by relating it to the standing intelligence requirements. (2) Ways to improve the degree and variety of access to the data base. (3) Means to preserve the level of detail provided by initial sensor inputs and collection reports. (4) Improvements in and increases to the number of ways that incoming bits of information can be linked to a given activity of current interest and to specific intelligence requirements. (5) Methods of storage that increase query possibilities and decrease the constraints affecting ad hoc research of current problems. (6) Techniques that can both provide alerts to items of priority interest and highlight significant data and relationships.

Analysis

The project has sought to develop automatic data processing support capabilities that can enhance both quantitative and qualitative activities analysis.

Production

The focus of the effort with regard to production has been on means for producer/data base interaction and automated output of specific products. This has included the development of specific programs.

Information management

To assist intelligence management efforts, project

TABLE 30

Naval Warfare Analytical Terminology

Primitive term:

(1) Naval warfare event - consists of a minimum of one surface, submarine or air unit conducting a minimum of one of the aspects of naval warfare in a given area over a given period.

Definition:

(1) Naval warfare activity - includes a minimum of one or more naval warfare events related in terms of their area and period; the aspects of naval warfare being practiced; and the identification, composition, and organization of the participating and target units.

Twelve aspects of naval warfare:

(1) Offensive operations. (2) Submarine launched ballistic missile operations. (3) Antisubmarine warfare. (4) Surveillance and intelligence collection operations. (5) Electronic warfare operations. (6) Cover and deception operations. (7) Amphibious warfare. (8) Logistics support operations. (9) Test and evaluation operations. (10) Research operations. (11) Defensive operations. (12) General operations (the null set).

Five quantitative variables:

(1) Size. (2) Period. (3) Scope. (4) Level. (5) Intensity.

Nine Qualitative descriptors:

(1) Force composition and disposition. (2) Communications use. (3) Sensor use. (4) Weapons employed. (5) Tactics employed. (6) Rigs and equipment. (7) Subordination of Units. (8) Participating personnel. (9) Target of the activity.

Ten participating unit types:

(1) Major combatants. (2) Minor combatants. (3) Submarines. (4) AGI. (5) Research vessel. (6) Auxiliary. (7) Merchant. (8) Fishing vessel. (9) Aircraft. (10) Friendly unit.

research has sought to accomplish the following : (1) Provide ways to measure current data base coverage of intelligence requirements. (2) Ensure means to identify information gaps. (3) Correlate data base content to requirements and products in the production schedule. (4) Relate data base content at the individual record level to specific needs of various consumers.

Naval Warfare Analytical Theory

Terms related to the concepts developed as the results of the formulation of naval warfare analytical theory in this section are outlined in Table 30. These terms include the naval event as the basic unit of construction of a naval activity, five discrete variables that can be measured quantitatively relative to each event, nine descriptors that may be applied qualitatively to each of the twelve aspects of naval warfare, and ten naval unit type designations.

Activity Variables

Naval activities can vary in terms of their size, period, scope, level and intensity. Observation and measurement of these variables relative to a given activity determine the parameters of that activity.

Size

This variable relates to the area encompassed by the

activity. An activity that is spread over a broad area is considered a large activity. Defining an activity primarily in terms of its area is dependent upon the individual focus of the particular analyst concerned. If the analytical interest or operational problem concerned is defined primarily in area terms, the area parameter might be specified as including all naval events in the Indian Ocean.

On the other hand, if the analytical interest or operational problem concerned emphasizes other parameters as the primary determinants in defining the activity in question, the area parameter of that activity would then correspond to the limits of the activity specified in accordance with the other parameters. For example, the analylitical interest or operational problem concerned may be Soviet surveillance of U.S. battle groups in the Indian Ocean. The size parameter would then include the area encompassed by the disposition of Soviet forces conducting that aspect of naval warfare against the U.S. forces. The limits of the complete geomtry of that area would extend to the area also filled by the disposition of the target forces that are the recipients of the interaction.

Measurement of the size parameter, thus, includes locating both the participant forces conducting the activity and the target forces that are the recipients of that activity. Completion of this observation and measurement

contributes to answering operational intelligence questions (1), (8) and (9).[102] These examples also demonstrate how answering the locational questions regarding adversary and friendly forces contributes to defining the extent of the naval interaction taking place and why locating data is the top priority of the ocean surveillance system.

Period

This variable relates to defining the duration of activity. The related events that comprise a given activity will occur over a definite period of time. They may occur continuously or intermittently. In either case, a certain continuity with regard to the conduct of these events will develop. In both cases, the duration of the activity corresponds to the difference between the times of commencement and termination. The latter time corresponds to either the activity's final cessation, or the time when a significant break in the continuity of the activity occurs. Acquiring a sense of continuity on a given activity assists development of its patterns, which in turn contributes to answering operational intelligence question (7).

Scope.

This variable is measured in terms of the number of aspects of naval warfare that are observed being conducted

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[102] See p. 210.

or practiced over a given period. For purposes of analysis, that period is normally specified as one day which corresponds to the report period for most intelligence summaries. This measurement permits comparison of a given activity with the evolution of that activity over time and with other activities both past and present. Completion of this measurement contributes directly to answering operational intelligence question (3).

Aspects of naval warfare

The theory developed in this project considers the aspects of naval warfare to include the following: (1) offensive operations, (2) submarine launched ballistical missile operations, (3) antisubmarine warfare, (4) surveillance and intelligence collection operations, (5) electronic warfare operations, (6) cover and deception operations, (7) amphibious warfare operations, (8) logistics support operations, (9) test and evaluation operations, (10) research operations, and (11) defensive operations. The basis for this determination is that, except for the addition of the last aspect, the other ten aspects reflect what is most often articulated in versions of the requirements for reporting on foreign naval operations issued at various levels of command.[103]

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[103] See discussion of tasking on pp. 81 and 82, and on intelligence collection plans in the section on institutionalized management activities on pp. 101 - 103.

It should be noted that, within a given naval activity, or even a given naval event, normally several aspects of naval warfare will be conducted either simultaneously or within the period of that activity under consideration. One obvious example is the fact that all naval operations require logistics support activities to sustain them. Surveillance and intelligence collection operations are a necessary prelude to offensive operations, as well as being the first line of defense. Amphibious warfare most often connotes performance of the power projection mission with the marines storming the beachhead. Amphibious forces may have had to conduct all other aspects of naval warfare just to get the marines to the beach.

While the connotation of most of the aspects of naval warfare may appear evident from the name of the aspect itself, those that may not are clarified below. Offensive operations are intended to include strike activities conducted against naval targets. This contrasts with submarine launched ballistic missile operations conducted against strategic targets ashore. The aspect of defensive operations is meant to include such activities as antiair warfare, task force and unit defense, protection of convoys, defense of sea lines of communications, costal defense, etc.

Finally, because activity exists that does not reflect any of the 11 aspects of naval warfare previously

named, a twelfth aspect must be designated. This aspect is termed general operations and it is designated to represent the null set, i.e. when none of the other aspects of naval warfare is identified as being conducted or practiced.[104] An example would be units deploying from the Soviet Pacific Fleet for service in the Indian Ocean. As they steamed to join the Tenth Eskadra, either independently or in groups, and as long as they do not conduct any of the other aspects of naval warfare; they would be reflected as conducting general operations under this theory.

Level

The level of a given naval activity is measured in terms of the numbers of its participating units. Measurement of this variable assists answering operational intelligence question (2). It should be noted that naval units, partiularly aircraft, are highly mobile. Individual units may enter into participation in a given event within the specified period. Then they may depart the area to participate in other events. Later they may rejoin the activity related to the first event. In fact, within a given period; individual units may participate

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[104]This concept, taken from set theory, was previously applied to indicate the limits of the total environment of an individual system. See pp. 34 - 37.

in several events, and even in several activities.

Intensity

This variable is defined as a combination of the number of events, types of participating units, and the capabilities of the participating units involved in a given activity. All of these factors contribute to the assessment of the degree of actual or potential threat to U.S. forces represented by the activity being observed.[105] Thus, this is the first variable whose quantitative measurement can assist addressing the more qualitative operational intelligence questions (4) and (5).

Relevance to activity patterns

Because all of these variables can be measured quantitatively, they contribute to the development of activity patterns by indicating changes in activity, direction of these changes and their magnitude.[106] Further, they permit the differentiation of the pattern of a given activity's evolution and comparison between activities.

Definition of an Activity

A general definition of a naval warfare activity

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[105] For definition of the concept of potential versus actual threat, see p. [illegible].

[106] See pp. [illegible] and 60.

was offered at the beginning of this section on analytical theory.[107] The sections that follow indicate how the general definition below was derived.

> A given naval warfare activity is defined to include a minimum of one or more naval warfare events related in terms of the area and period; the aspects of naval warfare being practiced; and the identification, composition, and organization of the participating and target units.

The naval warfare event, a primitive term

> A naval warfare event consists of a minimum of one surface, submarine or air unit conducting a minimum of one of the aspects of naval warfare in a given area over a given period.[108]

Construction of a naval warfare activity

As other units are related to the initial unit over time in accordance with the relationships specified by the naval warfare variables, the minimum event evolves into a more complex event. A naval activity, then, may correspond to a single event monitored over time. As the parameters of current analytical interests broaden and/or those of the current operational problem change; the parameters of the sampled activity will also broaden to include

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[107] See pp. 214 - 215.

[108] The application of the concept of an event as the basic unit of analysis for assessing naval warfare activity is analogeous to Sherwin's application of the same concept as the unit of analysis for assessing politico-military activity. See discussion on pp. 56 - 58.

a larger number of events, a bigger area, a longer period, a greater number of high interest units, and additional aspects of naval warfare. In essence, then, the parameters of a given naval warfare activity are defined to correspond to those related to current analytical interests or a given operational problem.

Activity Descriptors

To address the qualitative aspects of activity analysis, the theory now turns to the detailing of activity descriptors. The nine descriptors of aspects of naval warfare employed under this analytical theory include: (1) force composition and disposition, (2) communications use, (3) sensor use, (4) weapons employed, (5) tactics employed, (6) rigs and equipment, (7) subordination of units, (8) participating personnel, and (9) target of the activity. Like the naval warfare variables, these descriptors are the ones commonly used in versions of the reporting requirements on foreign naval operations.

Force composition and disposition

This primary descriptor is the only one that can be applied to every naval warfare event. In accordance with the definition of a naval warfare event above, it must include at least one participating unit. The composition of the force refers to the number of each different type of unit participating in the event. The disposition

of the force refers to the arrangement of the participating units within the area of the event and the location of individual units within that arrangement. Qualitative narrative data applicable to this descriptor contributes to answering operational intelligence questions (1) and (2).

Communications use

The use of communications by units participating in a given event assists ocean surveillance sensors to not only fix the location of these units, but also to identify the individual unit that is transmitting. Further, analysis of communications patterns can reveal organizational relationships, while decryption of participant communications can reveal both what they are doing and what they intend to do. Thus, qualitative narrative data applicable to this descriptor contributes to answering operational intelligence questions (1) through (3) and (7) through (9).

Sensor use

Like communications, the use of sensors by participating units can reveal their location and identity. Further, detection of the employment of various sensors by the ocean surveillance system provides clues as to what the participating units are doing, while observation of

and reporting concerning the use of these sensors from friendly units at the scene of the activity can confirm the aspect of naval warfare being conducted and indicate how well it is being performed. Thus, all operational intelligence questions may be addressed by qualitative narrative data applicable to this descriptor with the possible exception of question (7).

Weapons employed

Obviously reports applicable to this descriptor are of prime interest. Unfortunately, the opportunities to collect such data outside of actual combat conditions are rare. Adversary security measures attempt to preclude the possibility of such collection in peacetime. Such collection is essential to both capability analysis and threat assessment. Operational intelligence questions (3) through (6), (8) and (9) can be addressed by collection reports applicable to this descriptor.

Tactics employed

Successful countering of the adversary's tactics can preclude, or at least neutralize, his weapons employment. Collection reports applicable to this descriptor are essential to determining both how he exercises his capabilities and how well he conducts naval warfare. Thus, operational intelligence questions (3), (5) and (6) may be addressed

by reports applicable to this descriptor.

Rigs and equipment

This descriptor refers to the use of equipment other than communications, sensors and weapons. Normally, the collection and reporting of friendly units at the scene of the event is necessary to the provision of this data. The descriptor primarily is applicable to addressing of operational intelligence question (4).

Subordination of units

This descriptor refers to the organization of participating units and the command relationships that both exist between them and connect them organizationally to senior, lateral and subordinate commands that may be located physically outside the immediate area of the event. Operational intelligence questions (7) through (9) can be addressed by data applicable to this descriptor. Answers to these questions are derived primarily through analysis.

Participating personnel

This descriptor refers to both the identification of key personnel attached to participating units and observation of the activities conducted by the personnel of these units. Reports containing information relevant to personnel activities can fill in the flavor of what the adversary

is doing. Examples of such information include: "As the patrol boat passed abeam to port, her crew was noted at general quarters with all gun mounts manned and trained at NIMITZ. An orange flare was fired from the patrol boat's bridge toward the carrier." "The AGI was noted lowering a small boat. Its personnel maneuvered the boat astern of the task force and they began to sift through the trash which recently had been thrown overboard." As these examples illustrate, such reports focus on answering operational intelligence question (5).

Identification of key personnel contributes to satisfaction of the imperative necessary to the success of military operations, which was laid down many centuries ago by the Chinese philosopher Sun Tzu, "know thy enemy". What the commander would like to know about his adversary includes such factors as his training, professional education and development, career pattern, operational experience, naval philosophy, methods of operation, tactical preference, etc. Just beginning to draw the picture of opposing commanders with regard to these factors requires lengthy collection efforts involving the reporting of every scrap of information that can be obtained on key personnel as the collection opportunities present themselves. The analytical effort to construct this picture is just as extensive. This discussion illustrates how critical it is to collect this kind of data on opposing

personnel at every opportnity. Information that is available that applies to this descriptor can provide answers to operational intelligence questions (7) through (9).

Target of the activity

An individual event may include only one unit. Even if more units are included, they may not be conducting any of the aspects of naval warfare (i.e. only general operations).[109] When any of the other eleven aspects of naval warfare are being conducted, however, naval interaction is occurring. When interaction is occurring, there must be a target that is the recipient of that activity in addition to the participating units that are conducting the activity. Identification of the target, and knowledge of both the affect of the participating unit's activity on the target and the target's response to that stimulus are necessary to complete the assessment of an interactive naval event.

Thus, data applicable to this descriptor is a critical collection and reporting requirement. For the analyst to discern that the target of the activity is U.S. or other friendly forces, he must have knowledge of the location, identification and current activity of these potential targets. Relating reported adversary activity to potential U.S. force involvement should be regarded as the intelligence analyst's first maxim. Unfortunately,

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[109]See definitions, pp. 210, 220 and 222.

this is not always done. In some cases, the friendly information required may not be available to the analyst. In other cases, he may not be sensitive to this requirement. If after examination the analyst is unable to determine friendly force involvement in the activity, he should follow the second maxim that is applicable to complete activity analysis: Look for and differentiate the adversary units that are playing the role of the target in the activity being observed and reported.

Objectives of Activity Analysis

Based upon the theory outlined above, activity analysis can be considered successful if it satisfies the following criteria:

(1) The assessment and description of the naval warfare activity concerned is completed in terms of the basic variables and descriptors.

(2) The analysis derives relationships both among participating units and between events that comprise a given activity.

(3) The analyst compares events with one another and differentiates their content and development.

(4) Patterns of individual activities as they evolve over time, as well as unit associations, are developed and highlighted.

(5) The analysis indicates changes in activity in terms of its scope, level, intensity, direction, magnitude, and both the potential and actual threats that it implies.

Naval Warfare Information Management Theory

Given the development of this analytical theory, the

conceptual model related to the requirements of an information system that supports such analysis may now be specified. The specification of these requirements is divided into two models. The first addresses the analytical framework that should be provided. The second outlines system design criteria.

Framework for Analysis

Construction of the framework for analysis provided by the information system should be built upon and related directly to the requirements for reporting on foreign naval operations. These requirements have been issued as directives by the management components of the intelligence system. They have been implemented in a variety of forms at many levels of command lending a certain consensus as to their value. They have been proven by their endurance over time with substantively the same content. That content specifies the information required for analysis that pertain to each aspect of naval warfare. The specification is in terms of both the variables and descriptors associated with naval warfare activity. Satisfaction of the requirements specified answer the key operational intelligence questions. The construction of such an analytical framework in the information system should then be completed by ensuring that it supports the objectives of activity analysis. The end result will be

an information system that not only provides direct linkage to the tasking phase of the intelligence cycle, but also to the requirement of the other components of the naval system. Thus, consideration of the principal mission of intelligence will be considered in the design of the information system. That mission is to provide a product that will serve the other naval system components.[110]

System Design Criteria

Additional concepts related to the design of an information system that supports activity analysis include:

(1) It should be capable of accepting and providing access to a variety of data.

(2) It should provide query capabilities that permit a variety of analysts to formulate inquiries that are tailored to and can expand from their various specific interests.

(3) It must provide for the acceptance of data reported to OSIS.

(4) Its features must be compatible with those required by OSIS nodes.

(5) It should provide access to the data in terms of the variables and descriptors of naval warfare activities.

(6) It should provide for the preservation of relationships made between activities, events and participating units.

(7) It should be capable of assisting the comparison of activities and the developing of activity patterns.

(8) It should provide the means to measure observations of naval warfare variables, indicate

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[110] See discussion on pp. 79 - 81.

> the direction and magnitude of changes in activity with regard to these variables, and include capabilities for providing alerts to potential and actual threats.

Validation of the Models

Consideration of both the results of the systems analysis presented in Chapter II and the reality situation described in Chapter III has been the key to development of the conceptual models in this chapter. These models now provide the basis for the development of the scientific models in Chapter V, which outline the details of information system design, address the techniques for data manipulation and statistical packages that can provide these methods, and describe the report program development. The solution outlined in Chapter VI will then be related back to the models and the reality situation to complete the validation process.

V. THE SCIENTIFIC MODEL: THE NAVAL WARFARE ANALYSIS EXPERIMENTAL INFORMATION SYSTEM

Purpose

This chapter relates the automatic data processing support capabilities being developed through the Naval Warfare Analysis Experiment to improvements that could be made to the Ocean Surveillance Information System. The scientific model of an information system constructed in this project is based upon the conceptual model developed in Chapter IV concerning naval warfare analytical and information theory. Chapter VI will then assess the relevance of the conceptual and scientific models to both the intelligence system analyzed in Chapter II and the reality situation assessed in Chapter III. The proposals for solutions to the naval warfare activities analysis and threat assessment problems will be based upon this validation process.

Chapter V covers two groups of topics as follows: (1) Ocean surveillance and OSIS. (2) Naval warfare analysis experimental file design, query and data manipulation, output and report programs.

Ocean Surveillance and OSIS

System Description

Requirements and functions

The Ocean Surveillance Master Plan defines the ocean surveillance function as:

> "The systematic observation of ocean areas to detect, locate and classify selected high interest aerospace, surface and subsurface targets and provide this information to users in a timely manner."[111]

The plan then continues by citing the requirements for ocean surveillance to support command and control of operational forces, to contribute to and receive support from the intelligence system, and to provide target acquisition necessary for the support of over-the-horizon targeting. The plan divides these functions into those applicable to peacetime, crisis and wartime. It states that the peacetime functions of the system are supporting both capabilities. and activities analysis. In crisis, the system contributes to the indications and warning process that detects and assists perception of the evolution of these contingency situations. Finally, in wartime, the system must be capable of fulfilling the stringent

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[111]This definition and the requirements cited in this system description were extracted from the Ocean Surveillance Master Plan, (Washington, D.C.: Antisubmarine Warfare and Ocean Surveillance Program Office (OP-095), Office of the Chief of Naval Operations, September 1978), pp. 3 and 4.

operational requirement of over-the-horizon targeting.

This wartime tactical requirement dictates that the three highest essential elements of information of the operational commander, as stated in the master plan, are: (1) identification of enemy forces, (2) enemy position, (3) time of position. As a result, the ocean surveillance product must always provide the following data: location, accuracy, time of location, classification, confidence of classification and platform designator.

Characteristics of an ideal
ocean surveillance system

Based on these requirements, the master plan delineates the six primary characteristics of an ideal ocean surveillance system as follows:

(1) Provides coverage of high interest platforms anywhere in the ocean areas of the world.

(2) Has adequate resources to produce the ocean surveillance product in a timely manner on all platforms of interest.

(3) Is capable of direct tasking by users.

(4) Provides the ocean surveillance product directly to users.

(5) Is free of functions that impair timeliness.

(6) Has clearly defined responsibilities for management.

Location and arrangement

The ocean surveillance system and its intelligence component, OSIS, were fixed previously at the intersection

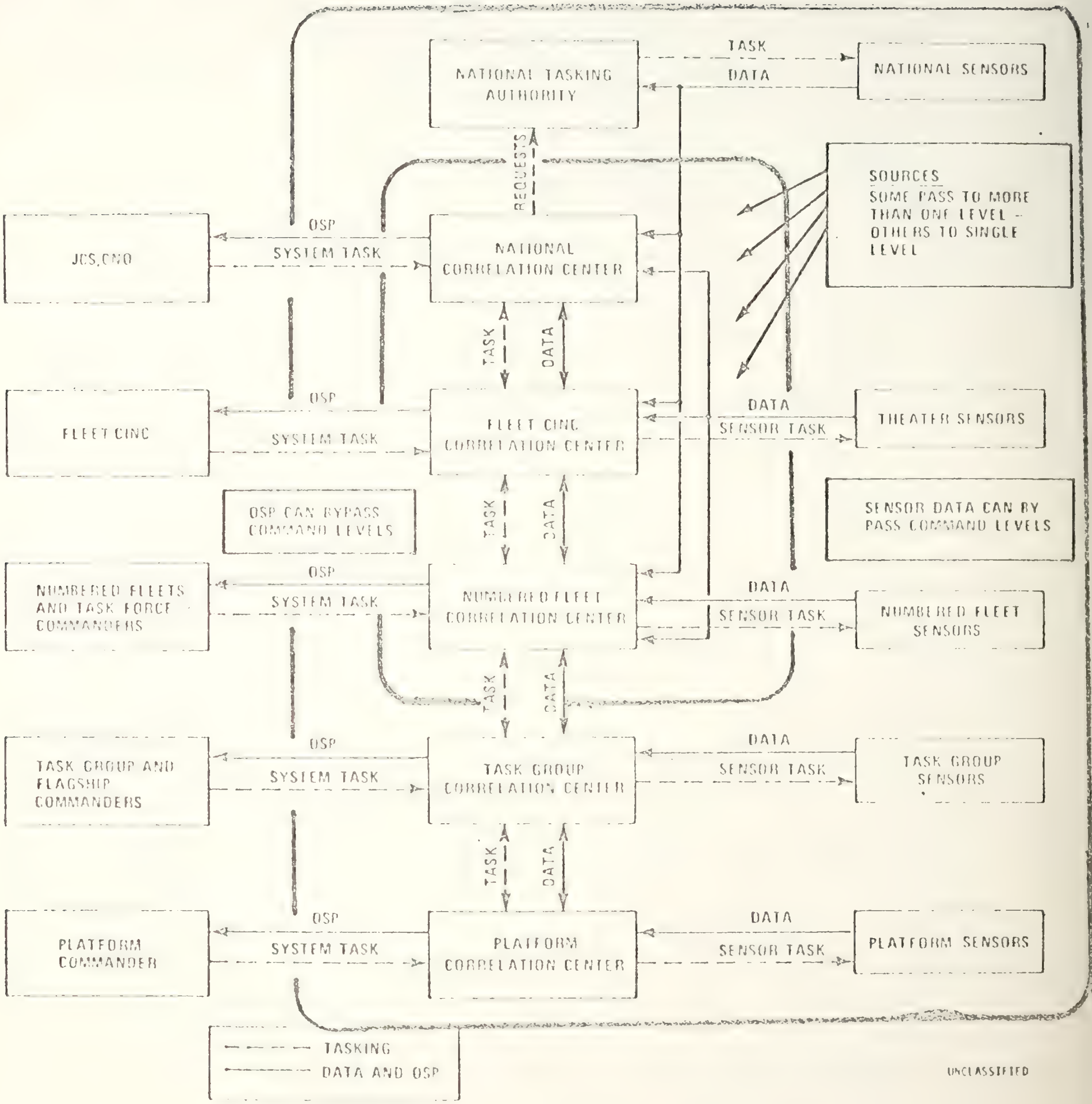

Fig. 25. Structure of Ocean Surveillance System and OSIS Nodes

of the operational and intelligence systems. Fig. 25 provides a detailed view of the structure of these two systems. The ocean surveillance system includes both sensor resources and correlation centers. The figure also shows the interface between the system and the command authorities at each level in the operational chain of command that control the functioning of the ocean surveillance system and its components. OSIS corresponds to the correlation centers located ashore. While manned by intelligence resources, these centers are under the operational control of the respective command authorities at each level in the chain. The task group and platform correlation centers are afloat. While the platform correlation center is manned primarily with operational personnel, substantial intelligence resources in afloat intelligence centers on board carriers and amphibious command ships function with and provide direct support to the operational correlation centers at the task group level.[112]

The OSIS Nodes

Sources and data base content

Fig. 26 depicts the information flow between the ocean surveillance system and an OSIS node, within the

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[112]Ibid., Fig. 2.1, p. 7. Compare the system description outlined in the Master Plan and the structure illustrated in this figure to the introductory discussion to the section on a functional description of the intelligence system provided on pp. 79 - 81, and Fig. 11 on p. 74.

node itself, and from the node to operational users. It further depicts sources of naval warfare activity data and automated support capabilities available to OSIS.[113] Fig. 27 illustrates a model of node functions proposed by Professor Paul H. Moose of the Naval Postgraduate School.[114] Data on naval warfare activities is provided primarily by operational intelligence and ocean surveillance sources. Note that the information base also contains environmental source data. Finally, the data base includes own force data which is a primary input that is necessary to complete effective activity analysis.[115] Finally, the figure also illustrates the OSIS analytical and data base inputs to the planning and decision making process.[116]

FOSIF functions

Lyman's research included a thirty day observation period at the Fleet Ocean Surveillance Information Facility (FOSIF), Rota, in which he measured and recorded the activities of that organization in order to develop his

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[113] Ibid., Fig. 3.1, p. 36.

[114] Rod Guy Lyman, "A Cybernetic Characterization of the Fleet Ocean Surveillance Information Facility at Rota, Spain", a thesis completed for the degree Master of Arts in Naval Intelligence, (Monterey, California: U.S. Naval Postgraduate School, March, 1979), Fig. 5, p. 15.

[115] See discussion of target activity, pp. 228 - 229.

[116] See service to other naval system components, pp. 92 - 95.

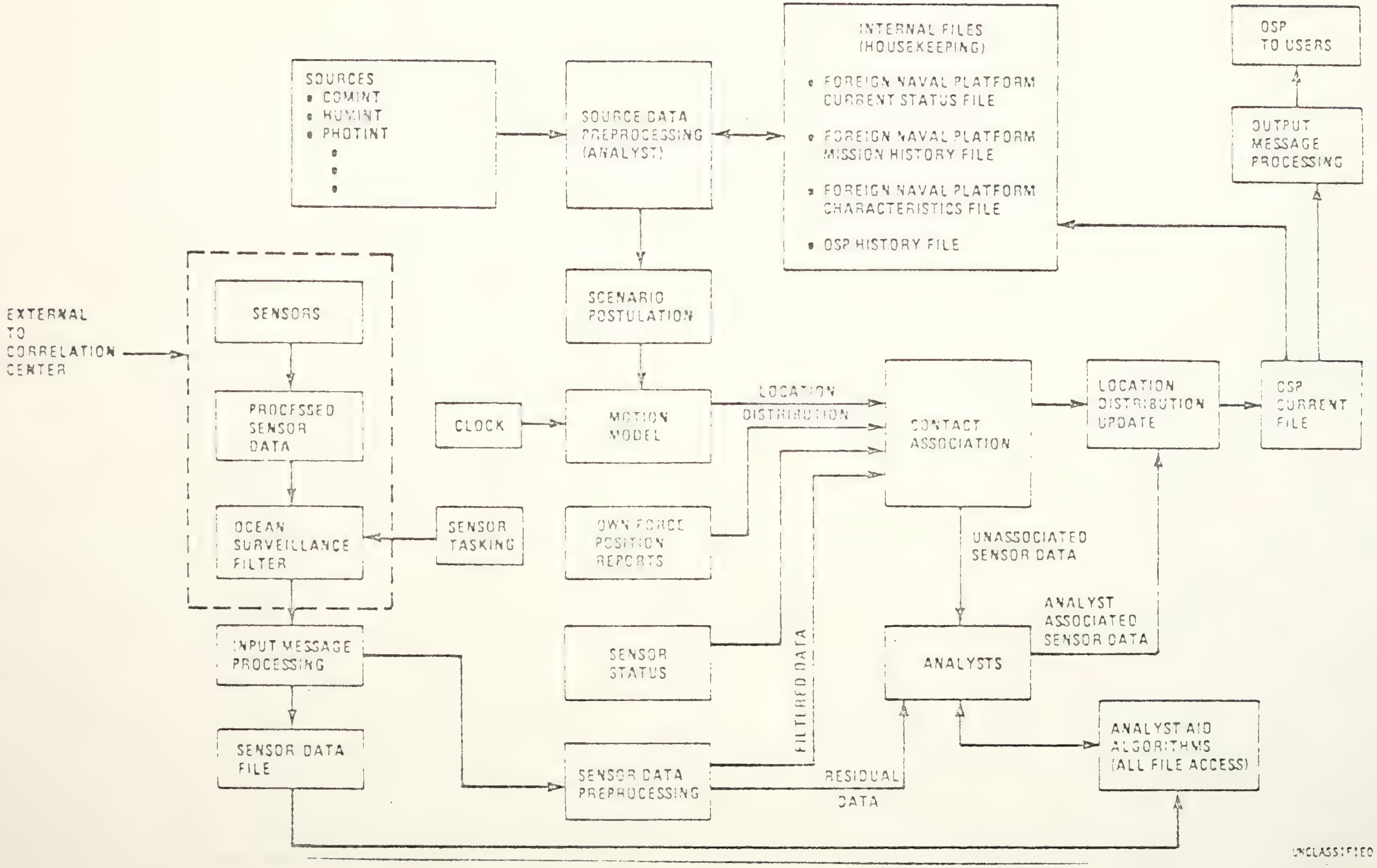

Fig. 26. OSIS Information Flow

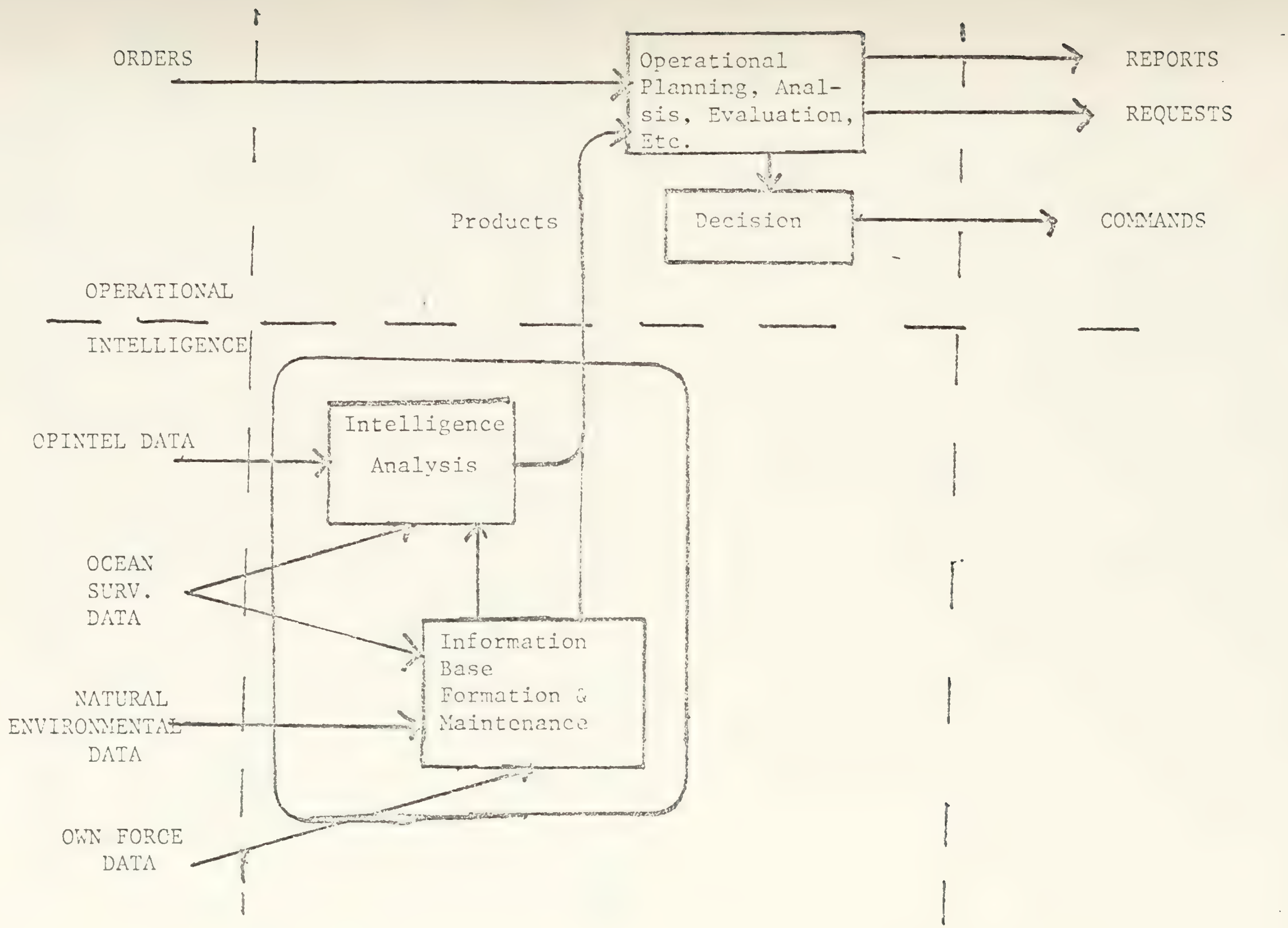

Fig. 27, Model of an OSIS Node Supporting the Fleet

cybernetic model of its functions. He categorized FOSIF activities as being applicable to one or more of the six following functions: switching, filtering, associating, archiving, encoding, reporting and controlling. Fig. 28 depicts the FOSIF Watch area, while Fig. 29 shows the complete internal geography of the FOSIF. Note that there is a division of labor between the analytical section, which maintains long term continuity on ocean surveillance events and patterns of activity, and the watch section, which ensures continuing performance of FOSIF functions on a twenty-four hour a day basis and provides the immediate intelligence support to the fleet.[117]

Switching

This is a one-to-one transform operation in which the inputs from collection sources are related to the requirements of the node, annotated, and then routed to the cognizant participant. The function is performed primarily by the Senior Watch Officer (SWO).

Filtering

This function is a subset of the switching function that provides two options. Either the information is retained and directed into the node, or it is discarded.

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[117] Lyman, "Cybernetic Characterization of the FOSIF", pp. 19 - 30, including Fig. 9 on p. 30 and Fig. 10 on p. 24.

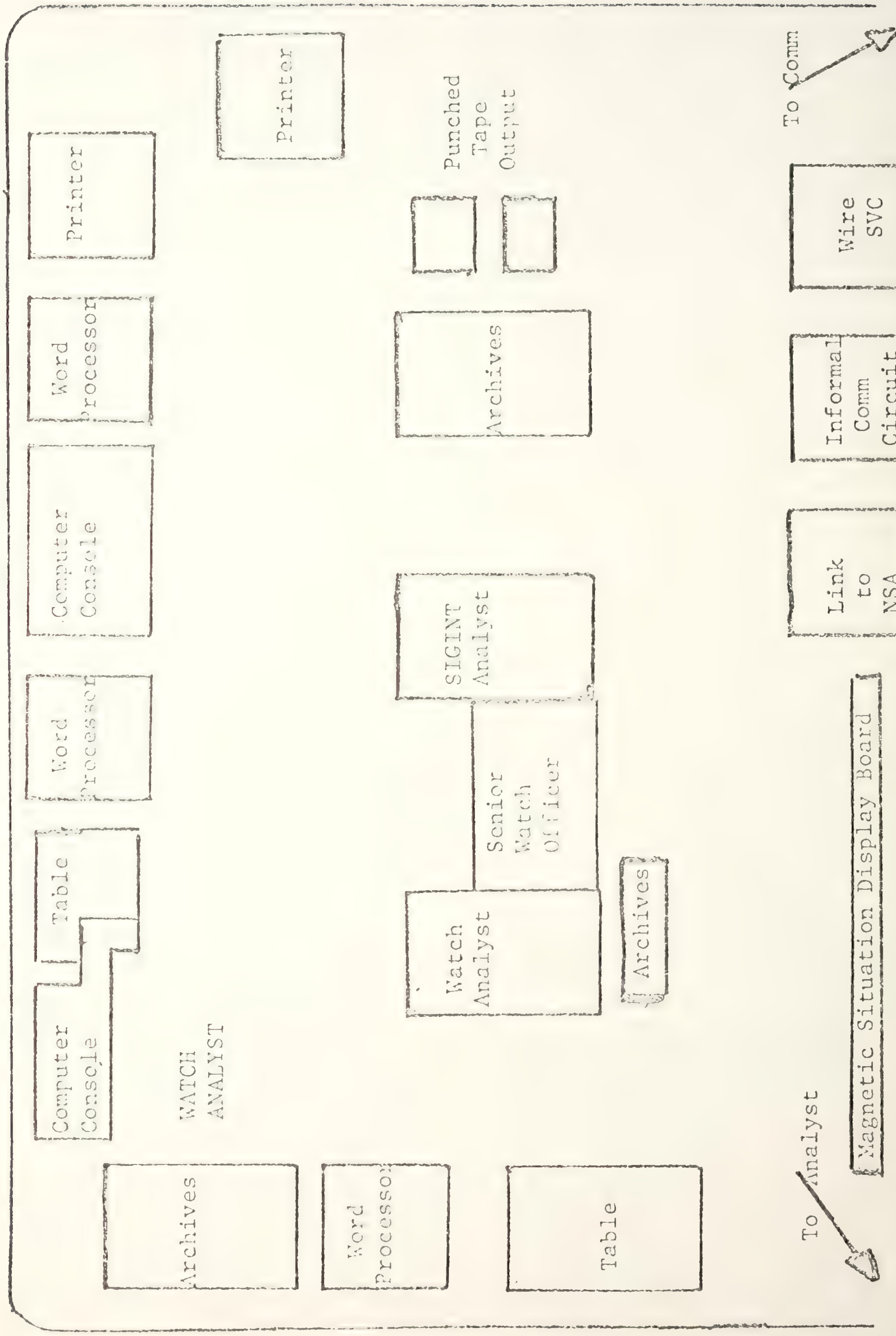

Fig. 28. FOSIF Watch Area

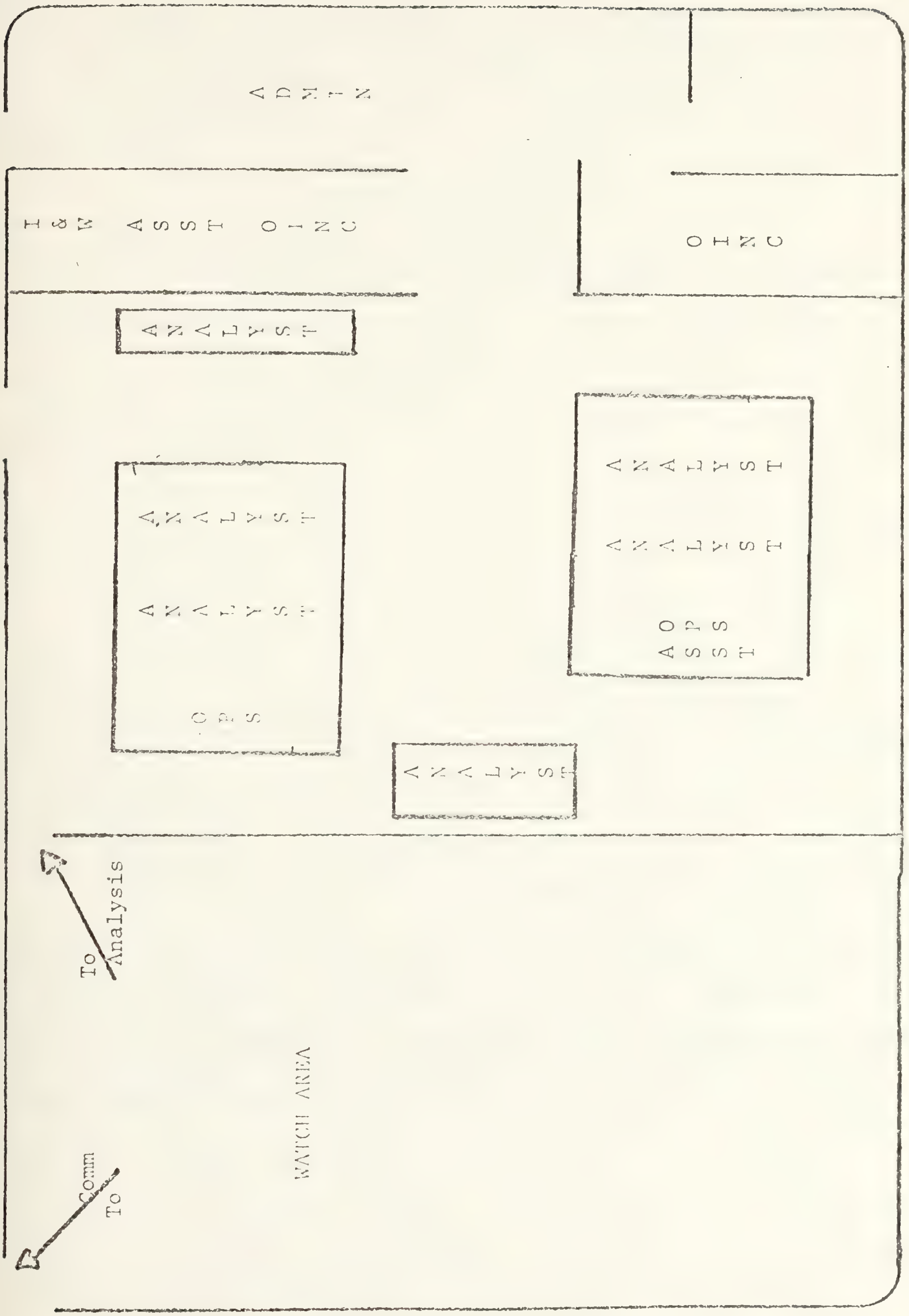

Fig. 29. FOSIF Internal Geography

Thus, if information is blocked by the filter, it becomes irretrievable. Lyman estimated that forty percent of incoming message traffic was blocked by the filter at FOSIF Rota.

Associating

This step in the process occurs after the cognizant participant in either the watch section or the analyst section receives incoming information that has passed through the switch. The difference between the functions of switching and associating is that the former matches the incoming bit of information with a functional role of one of the participants in the organization, while the latter matches the bit that has been switched to his immediate concerns and to information in the data base. Additional filtering obviously takes place in this process.

Archiving

This is primarily a storage rather than a transform function. In some cases, the incoming bit will be decoded in order to change its format to that more compatible with data base requirements. Lyman observed two types of archives at the FOSIF. The first he designated Archive I. This related to the stacking of untranslated radio broadcasts, raw formatted message reports, and others whose symbology and content had not been decoded. Archive II then pertained to that information that had been decoded into a symbology

and language readily digestible by the node and stored in the data base.

Encoding

This function relates to the production of the FOSIF product. It includes the subfunctions of organizing, drafting and reviewing the outgoing message, as well as changing the physical form of the product from the electronic image on the cathode ray tube to punched tape for dissemination by the communications system.[118]

Reporting

This function refers to the dissemination segment of the intelligence cycle. Most reporting at the FOSIF was accomplished with the watch team acting as the encoder. In cases of messages encoded by other FOSIF participants, the watch team served as a transmission channel.

Controlling

At the FOSIF, this function involved policy direction and the establishment of activity goals by the Officer-in-Charge (OIC). Feedback to the OIC from individual participants occurred both formally and informally. The institutionalized mechanism for this feedback was the daily morning meeting at which progress on various

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[118] Lyman based his concept of encoding on that drawn by J.G. Miller in Living Systems, (New York: McGraw-Hill Book Company, 1978), p. 3.

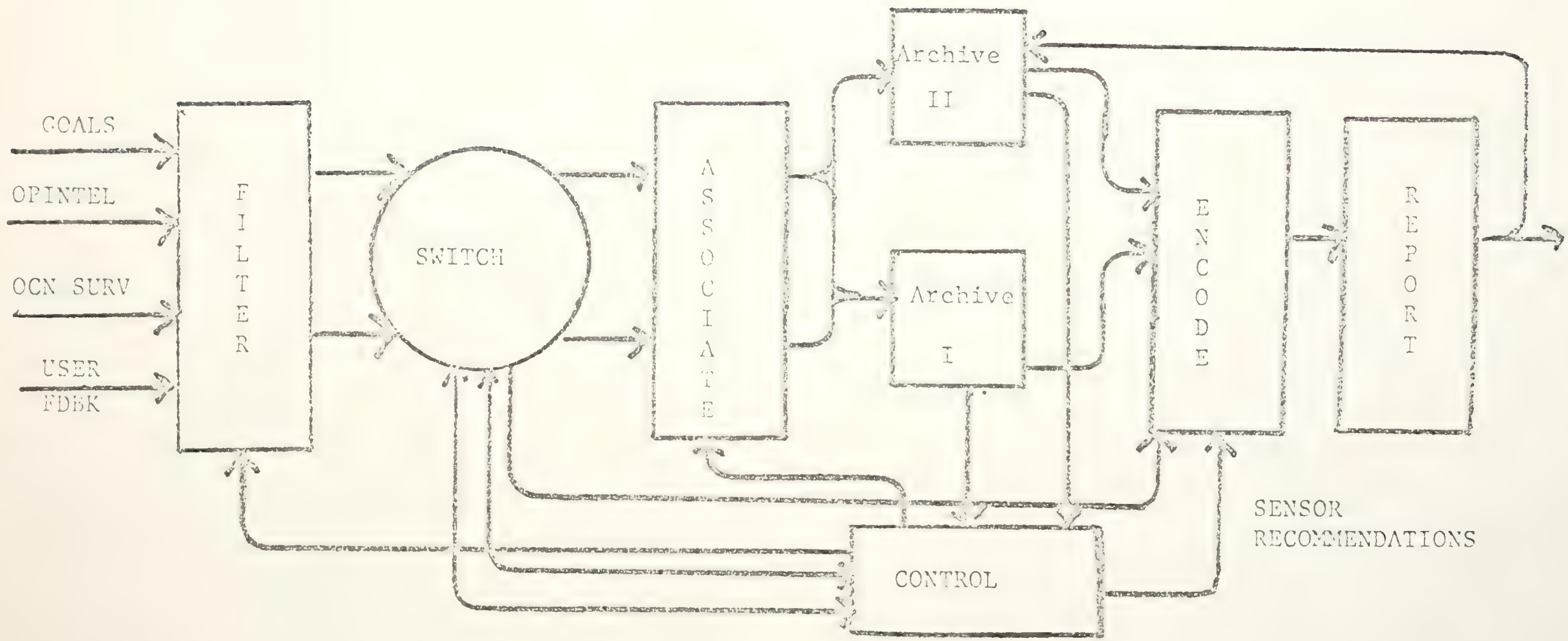

Fig. 30. Lyman's Cybernetic Model

activities and significant items of interest were discussed. The SWO performed the controlling function for the watch team. Lyman noted that other than the direction and supervision of the information flow, control exercised by the SWO would not normally be visible once individual watch members had been trained adequately and they had accumulated sufficient expertise and proficiency through practice.

Participant roles

Based upon the functional description above, the roles of individual FOSIF members can be summarized as being applicable to the following functional roles: Data base maintenance and quality control, data base interaction and analysis, report production and dissemination, and data base management and system control. The model that Lyman developed as a result of his research reflects the performance of these roles. This model is shown in Fig. 30.[119]

Current OSIS ADP Support

Figs. 26 and 27 on pages 239 and 240 also showed OSIS data sources and indicated current automatic data

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[119] Ibid., Fig. 11, p. 25, Fig. 13, p. 40 and Fig. 14, p. 41. Also compare this functional and role description to the systems analysis of the intelligence cycle on pp. 81 - 92, and the discussion of the intelligence officer as an analyst on pp. 111 - 114.

processing support capabilities that are available in some form to most OSIS nodes. These support capabilities will now be discussed as they relate to the processing, analysis, production and dissemination segments of the intelligence cycle.

Processing

While OSIS receives much of its data in automated form, some it does not and perhaps never will. The latter case relates primarily to communications intelligence (COMINT), human intelligence (HUMINT), and photographic intelligence (PHOTINT) sources. Some of the operations and intelligence reporting from the fleet also can be included in this category. The significant portion of OSIS input that is received in automated form includes the ocean surveillance sensor data and fleet reporting that is transmitted in the automated Navy formatted message system prescribed by the Chief of Naval Operations. Even in this case, however, not every OSIS node has the message input capability necessary to accept all the data contained in these formatted reports.

With regard to data base files, as illustrated in Fig. 26, these include: (1) the foreign naval platform current status file, (2) the foreign naval platform history file, (3) foreign naval platform characteristics file, and (4) the ocean surveillance product history file. The first of these normally contains information

known to U.S. intelligence concerning the operational and readiness status of surface, air and submarine platforms. This file would provide such indications as a given unit is deployed out-of-area, is in a training or operational readiness status in-area, is in overhaul, or is under construction, etc.[120] The second file would contain both track data (positional, event time and unit trademark data) and narrative information concerning the present and past deployments of units of interest that currently are operating out-of-area. The narrative entries normally include short summaries and analytical comment concerning the activities and associations of each given unit. The extent of coverage and detail these entries provide varies from node to node with the file at the Navy Ocean Surveillance Information Center (NOSIC) being more substantial than that at the lower levels of the system. The third file contains characteristics of individual platforms that can be detected and identified by ocean surveillance sensors. The last file would contain the daily intelligence summaries disseminated by the node.

Analysis

With regard to the analytical function, this section covers the following topics: quantitative analysis, qualitative analysis, and analyst/system interaction.

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[120] See Fig. 16 on p. 169 and discussion on p. 168.

Quantitative analysis

The quantitative aids currently provided OSIS are used primarily to support the contact identification and correlation functions. Certain algorithms can compare incoming sensor information to that contained in the platform characteristics file to match the unit detected with a given known unit. Other algorithms determine the probability of the possible candidates that may be associated with a given contact report and then rank order these candidates from likely to least likely to assist the analyst's assessment of the proper correlation. These algorithms use not only identification characteristics to make this determination, but also space and time factors. Algorithms capable of computing space and time factors can project target movement by dead reckoning methods and determine the time of its entry both within the sensor and weapon's envelopes of friendly task groups and within the detection and threat envelopes posed by the target's sensors and weapons. They can also compute necessary courses, speeds and routes to close or evade the target detected by the over-the-horizon sensors, or project the navigational tracks on which friendly forces are sailing.

Other quantitative aids provide capabilities for graphical and tabular display. Key among these are mapping and area displays that can both expand and contract in scale. Including multi-color features, some of these

graphics packages provide highly visual, effective analytical tools.

Qualitative analysis

The current status, mission history, and ocean surveillance product files described above provide the principal means of qualitative analytical support. The means of access varies with each file. The first two would be primarily by unit identifiers and perhaps by unit type. The first file may have a home fleet or port access capability. Track data in the second file can also be accessed by position and time queries. The product file is accessed primarily by the date time group of each individual message that it contains.

Analyst/system interaction

Intelligence terminals produced by Interstate Electronic's Corporation have been introduced into OSIS. Figs. 30 and 31 illustrate the analyst's console system and dual screen presentations that these terminals provide.[121] The technology reflected in these terminals employs the power of mini/micro architecture. It features an effective hierarchy of local, in the console processing power and memory for data sorting and inquiry/communications

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[121] These illustrations and the comments in this section were extracted from a marketing brochure issued by Interstate Electronic's Corporation in 1977.

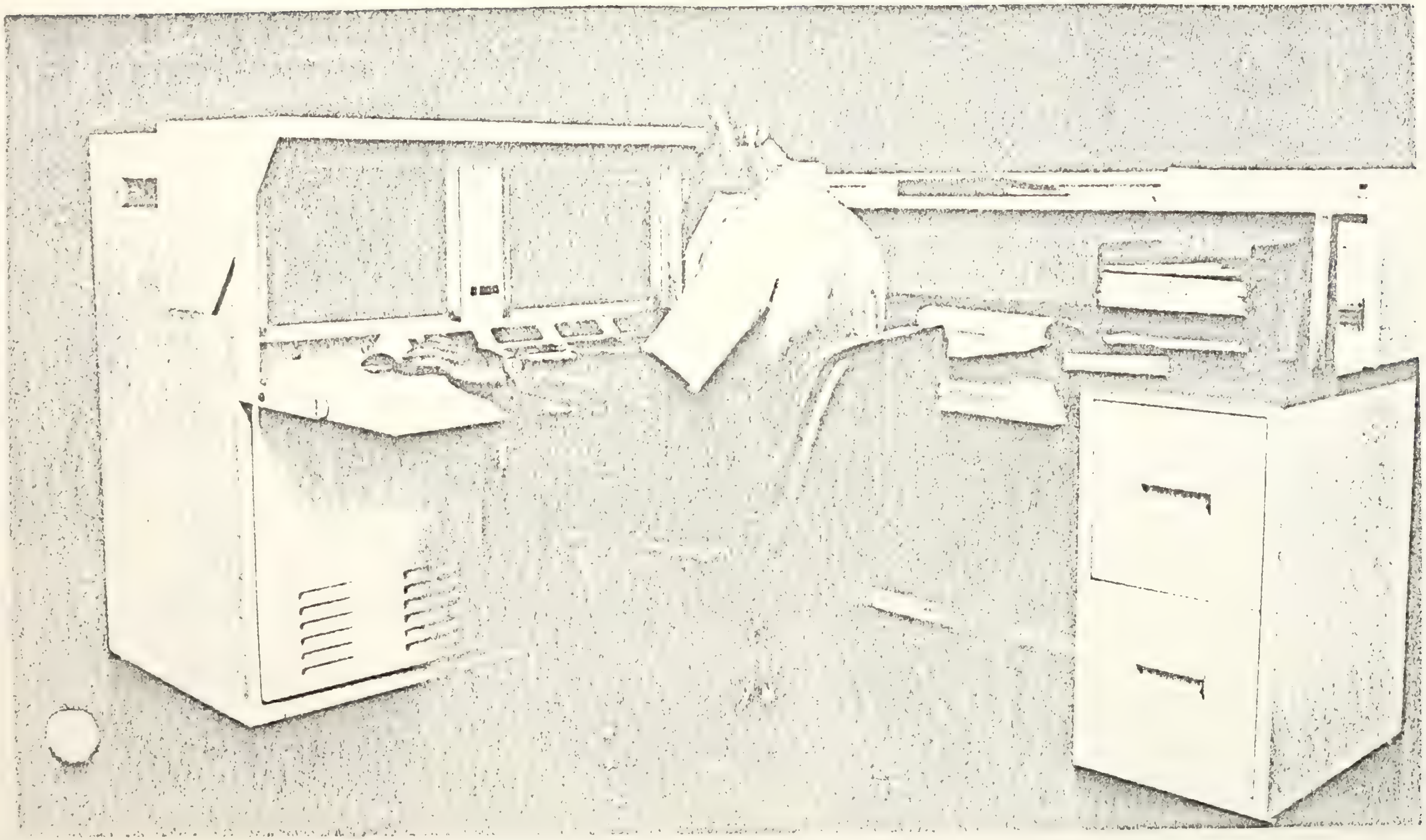
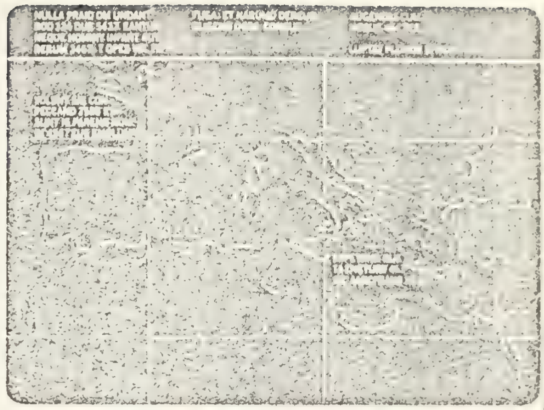
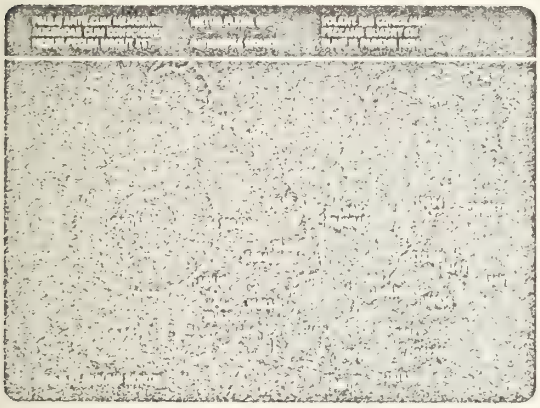


Fig. 31. Analyst's Console System

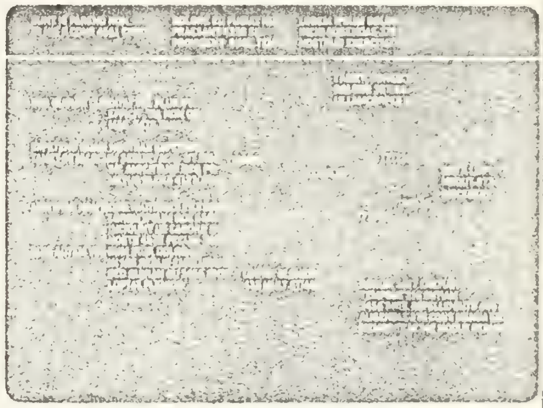
Widerange map with tracks.



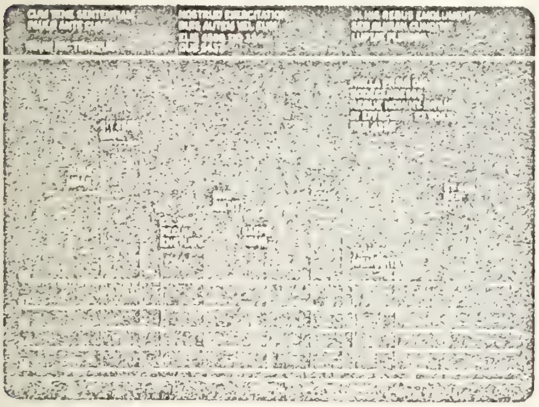
Specific sector map with analyst's annotation.



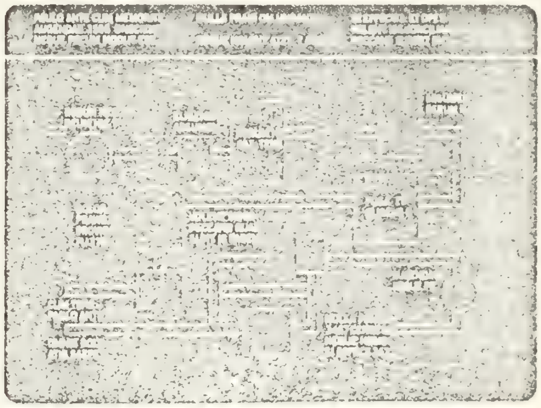
Close-up with full annotation.



Full description of data base content for a single track.



Histogram.



Flow Diagram

Fig. 32. Dual Screen Presentations

processing, coupled uniquely with the color CRT's high resolution. In addition to the dual color, 19 inch diagonal CRTs, the system's features include 512 x 483 viewable pixels on the two CRTs with a small 0.31 mm color dot trio spacing. Six refresh memory planes provide eight primary display information groups for each monitor. The graphics generator is capable of an instantaneous write speed of 142,000 points per second for vectors and 14,200 characters per second. The keyboard is ASCII conversational with special function keys, 16 fixed function keys and 160 changeable functions. Hairline graphics are controlled by a rate sensitive trackball, while the alphanumeric cursor is under software control. The terminal to computer interface is provided by a zoom keyboard for the graphics scale factor, a DMA data bus, and interrupt parallel control for keyboard and color transformation. All system modules are written in FORTRAN-IV, to gain independence from specific hardware requirements.

Production and dissemination

Automated support of these segments of the intelligence cycle includes report formatting, text editing, word processing, printing and message output processing capabilities. The extent to which each of these capabilities are available to the respective nodes varies.

Naval Warfare Analysis Experimental File Design

Data Base Records

This section includes five topics as follows: Technical constraints, hierarchical set organization, indexed-sequential access method (ISAM), and construction of record fields.

Technical constraints

Certain constraints were introduced into the design problem due to the fact that the experimental files would be run and tested under the analyst working file program installed on the Naval Intelligence Command On-Line System (NICOLS). Some of these constraints would apply to other programs as well as Work File. Some, however, were dictated by the particular requirements of the Work File software. The CULPRIT utility program produced by the Cullinane Corporation as one of the principal features of their information data base management system (IDMS) and installed on NICOLS was found to be a highly versatile and effective package. The constraints stemmed from the fact that the Work File program included only a limited application of CULPRIT. The limitation in the Work File design is purposeful because it is intended to be a simplistic program to facilitate its use by analysts having only a layman's familiarity with and working

knowledge of computer programs. Further, it is intended that such analyst use be performed based on the straightforward guidance contained in the NICOLS manual, with only limited intervention, if any, by data processing and programming personnel. Thus, the requirements of the Naval Warfare Analysis Experimental Programs far exceeded the capabilities of Work File procedures and features. The degree of success in the project to date in overcoming these constraints may be attributed to the significant versatility of the CULPRIT utility program and the patience, understanding, knowledge and professionalism of the programming and operations personnel at the Naval Intelligence Processing Systems Support Activity (NIPSSA) in Washington, D.C., who have assisted the author in various stages of the project to conduct NAVWARANALEX tests.

The specific constraints operative in the design process were: Record size was restricted to 500 characters of data input. Each record consisted of ten rows with 50 characters to each row. The record identification, file identification, and file maintenance function fields, however, were in addition to the 500 character data input. These fields totaled 27 characters. Only one record type, known as WORKFILE-ENTRY, was permitted under the Work File program. Field size was limited to 132 characters due to output considerations. Field length, however, could be either fixed or variable and each field could recur a

fixed or variable number of times. These capabilities may be employed to a greater extent in CULPRIT than in Work File. As indicated above, each record under Work File must have a unique record indentification field. Program processing is then accomplished sequentially in record identification order. (Normally, CULPRIT would allow direct path processing of the data base.)

Hierarchical set organization

The records in the experimental files are organized hierarchically into three sets of record types as shown in Table 31. The first set is termed the reference record set, the second is the event narrative record set, and the third is the unit record set. The material provided in the first record set is for analytical support, file documentation and management purposes. These records contain both fixed length structured fields and variable length narrative fields. The narrative fields are based primarily on analytical comment. The second set corresponds to the descriptors of the aspects of naval warfare.[122] These records have fixed length fields that recur a variable number of times and variable length narrative fields. The content of these narrative fields is based on both collection reports and analytical comment. The third set of

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[122]These descriptors are defined and discussed on pp. 223 - 229.

records form subsets in the hierarchy under each event narrative record type. These records contain fixed fields only. These fields may recur up to twenty times per record. All the data contained in these records is applicable to a specific individual track unit. Under current OSIS, a track unit may be an individual surface ship or submarine that is operating out-of-area. Under NAVWARANALEX, a track unit may also equate to a type of aircraft flown by a specific nation. The associated records column of the table also shows network relationships between these records.

Indexed sequential access method

As mentioned in the section on technical constraints, the Work File program allows only one record type, WORKFILE-ENTRY. The system then processes these records sequentially by the unique record identification field. The design of the file, however, called for a hierarchy of record types as discussed in the previous section. Because Work File established only the one record type, test programs would not be able to take advantage of CULPRIT's capability for direct path access. Work File does allow taking advantage of CULPRIT's sort capabilities. Therefore, the solution followed to permit the testing of data files that conceptually involved many different record types under a program that established only one record type included the following: First, the fields applicable to each record type in the

TABLE 31

NAVAL WARFARE ANALYSIS RECORD HIERARCHY

SET NAME	RCD HIER NO	RECORD TYPE	ASSOCIATED RECORDS
REFERENCE	01	REQUIREMENTS (REQREF)	ALL EVENT NARRATIVE RECORDS
REFERENCE	02	AREA (AREARF)	PORTAR UNIT RECORDS
REFERENCE	03	SURFACE ORDER OF BATTLE (SURFOB)	TRACK UNIT RECORDS HFDF UNIT RECORDS
REFERENCE	04	SUBMARINE ORDER OF BATTLE (SUBOOB)	TRACK UNIT RECORDS HFDF UNIT RECORDS
REFERENCE	05	AIR ORDER OF BATTLE (AIROOB)	AREA OF REFERENCE RECORDS TRACK UNIT RECORDS HFDF UNIT RECORDS
REFERENCE	06	DOCMNT	ALL - THESE RECORDS DOCUMENT THE FIELDS APPLICABLE TO EACH RECORD TYPE
REFERENCE	07	TABLE	GENERAL - THESE RECORDS DOCUMENT THE VALUES APPLICABLE TO FIELDS IN VARIOUS RECORDS
EVENT NARRATIVE	10	FORCE COMPOSITION (FORCOM)	REQREF REFERENCE RECORDS TRACK, BRGELP, PORTAR AND AREA UNIT RECORDS
UNIT	11	TRACK	SURFOB, SUBOOB AND AIROOB REFERENCE RECORDS. FORCOM EVENT NARRATIVE RECORDS ALL UNIT RECORDS
UNIT	12	BEARING-ELLIPSE (BRGELP)	FORCOM EVENT NARRATIVE RECORDS. TRACK UNIT RECORDS
UNIT	13	PORTS-AREAS (PORTAR)	FORCOM EVENT NARRATIVE, AREARF REFERENCE AND TRACK UNIT RECORDS
EVENT NARRATIVE	20	COMMUNICATIONS USE (COMUSE)	REQREF REFERENCE RECORDS HFDF UNIT RECORDS
UNIT	21	HIGH FREQUENCY DIRECTION FINDING (HFDF)	COMUSE EVENT NARRATIVE RECORDS TRACK UNIT RECORDS
EVENT NARRATIVE	30	SENSOR USE (SENUSE)	REQREF REFERENCE RECORDS ELINT UNIT RECORDS
UNIT	31	ELECTRONIC INTELLIGENCE (ELINT)	SENUSE EVENT NARRATIVE RECORDS TRACK UNIT RECORDS

TABLE 31
(Continued)

SET NAME	RCD HIER NO	RECORD TYPE	ASSOCIATED RECORDS
EVENT NARRATIVE	40	WEAPONS EMPLOYED (WEAPEM)	REQREF REFERENCE RECORDS WEAP UNIT RECORDS
UNIT	41	WEAPONS (WEAPS)	WEAPEM EVENT NARRATIVE RECORDS. TRACK UNIT RECORDS
EVENT NARRATIVE	50	TACTICS EMPLOYED (TACEMP)	REQREF REFERENCE RECORDS REACT UNIT RECORDS
UNIT	51	REACTION (REACT)	TACEMP EVENT NARRATIVE RECORDS. TRACK UNIT RECORDS
EVENT NARRATIVE	60	RIGS AND EQUIPMENT (RIGEQP)	REQREF REFERENCE RECORDS SIGSUM AND RIG UNIT RECORDS
UNIT	61	SIGNALS SUMMARY (SIGSUM)	RIGEQP EVENT NARRATIVE RECORDS. TRACK UNIT RECORDS
UNIT	62	RIGS (RIG)	RIGEQP EVENT NARRATIVE RECORDS. TRACK UNIT RECORDS
EVENT NARRATIVE	70	SUBORDINATION OF UNITS (SUBORD)	REQREF REFERENCE RECORDS
EVENT NARRATIVE	80	PARTICIPATING PERSONNEL (PERS)	REQREF REFERENCE RECORDS
EVENT NARRATIVE	90	TARGET OF THE ACTIVITY (TARGET)	REQREF REFERENCE RECORDS SENEVT UNIT RECORDS
UNIT	91	SENSOR EVENT (SENEVT)	TARGET EVENT NARRATIVE RECORDS. TRACK UNIT RECORDS

experimental files were redefined on the same 500 character WORKFILE-ENTRY record. The unique record identification field then was structured into subfields that would permit the CULPRIT sort capabilities to distinguish between the records desired for a particular test program and exclude the remaining records in the data base from that particular test run. If the system had permitted direct access to different record types, then CULPRIT's direct path capability could have been employed. In such a case, both the heirarchical and network relationships applicable to the file could have been identified to the system as CULPRIT paths and indexed sequential processing could have been achieved. This method would provide OSIS with a more effecient means of processing than can the Work File Program.

The record identification group field

The elements of the record identification group field in the experimental files are constructed differently in the reference record set than those in the event narrative and unit record sets. In the reference record set, the first five characters of the sixteen character record identification group field are divided into two elements as follows: The first element consists of three numeric characters and is designated the reference number (REF-NO) field. The second element consists of two alphanumeric characters and is designated the narrative identification

(NARR-ID) field. Its values correspond to the descriptors of the aspects of naval warfare. In the event narrative and unit record sets, these five characters comprise one numeric field. This element is designated the event number (EVT-NO).

The remaining elements in the record identification group field are the same for all three record sets. They include the following: The next element is a six character alphanumeric field designated the record type (RCD-TYPE). It is followed by a two character numeric element designated the record hierarchy number (RCD-HIER-NO). The final element in the sixteen character record identification group consists of a three numeric character field designated the record number (RCD-NO). This number provides a network linkage between all records applicable to a given record type that is applicable to a given event number.

The charateristics of these elements allow CULPRIT to distinguish and sort the records in the experimental files in a variety of ways. Examples include the following: The records in the event narrative and unit record sets can be sorted in event number order, within event number by either record type or record hierarchy number, and within that division by record number. A similar sort for the reference record set would vary slightly. First would be the sort by reference number, within reference number by either record type or record hierarchy number, within that

division by the narrative identification element, and within that by record number. If an analyst wanted to obtain all records in the file applicable to the same descriptor of the aspects of naval warfare, he would first get the event narrative records by the record type corresponding to the descriptor he desired. He could obtain the unit records applicable to that descriptor by employing greater than, less than test operations in his program to define the range of record hierarchy numbers applicable to that descriptor. To obtain the applicable reference records, he would request the narrative identification element that corresponded to the descriptor he desired.

Finally, the key role played by the record hierarchy number element in the sort should be noted. The record type element permits the sorting of the event narrative record set according to the descriptors of the aspects of naval warfare as described above. Not only will a sort in record hierarchy number order accomplish this same objective, but also it will include the unit records applicable to each event narrative record type in the sort. The purpose of this element, then, is to sort the file in the hierarchical order outlined in Table 31. Further, if the primary sort on the event narrative record and unit record sets is by event number, all the records that apply to each given event will be in the proper hierarchical order. Finally, this element also permits given records to be

selected for extraction by an output program on the basis of numeric test operations.

<u>Construction of record fields</u>

The construction of the fields applicable to the various record types was based upon several primary sources in order to ensure that the data content of these records was compatible with that required by OSIS. The first of the sources elected to provide the foundation for record fields was the Navy formatted message system. This automated message system serves as a primary input to both OSIS, as described above, and to the World Wide Military Command and Control System (WWMCCS).[123] The second source used was the DIA automated order of battle. This source was chosen because it contains fields that are applicable to the OSIS platform status and mission history files and indicates the proper structure of these fields. The fields concerned are those that relate to platform operational and readiness status, overhaul and construction, and unit trademarks or identifiers.[124] These fields are applicable to the order of battle records in the reference record set. The third

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[123] OPNAVINST C3431.1B, "RAINFORM Formatted Message Reporting System", (Washington, D.C., Office of the Chief of Naval Operations, 1 November 1973). Also see p. 248 of this thesis.

[124] DDB-1200-101-78, <u>Naval Order of Battle: USSR and Eastern Europe</u> (U). (Washington, D.C., Defense Intelligence Agency April 1978), Vol I, pp. viii-x. Also see fig. 26, p. 239 and discussion on pp. [illegible] - [illegible] of this thesis.

source provided the specific format used for the incorporation of the requirements for reporting on foreign naval operations into the file and for the designation of the various essential elements of information (EEI). This source was the U.S. Atlantic Fleet Naval Forces Intelligence Collection Manual.[125] Documentation of these fields can also be found in official government publications published under the auspices of the Naval Electronics Command.[126] Overall guidance for field construction and record design was based upon the manuals for NOSIC analysts' use of the SEAWATCH system.[127]

Event narrative records

The construction of the fields in the event narrative records reflected a particular design problem. It was intended that these records should contain not only narrative applicable to a particular descriptor of the

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[125] U.S. Altantic Fleet Naval Forces Intelligence Collection Manual (AFNFICM)(U), (Norfolk, VA.: Commander-in-Chief, U.S. Atlantic Fleet, 19 March 1975), Vol. II, pp. 11-34 through 11-34n.

[126] See "Description of the OSIS Baseline Correlation", (Falls Church, VA,: CTEC, Inc., January 1979), Prepared for the Naval Electronics System Command. Also see the Operators Handbook series prepared by the Lockheed Missile & Space Company, Inc., Navy Tactical Data Programs, Space Systems Division of Sunnyvale, CA., for the Naval Electronics System Command.

[127] NIPSSA Document No. 01B001 00-UG-01, Ocean Surveillance Information System, SEAWATCH System User's Guide for NOSIC Analysts(U), (Washington, D.C.: Naval Intelligence Processing System Support Activity, Naval Intelligence Command, 15 August 1972), Vols. I and II.

aspects of naval warfare; but also the numbers of each EEI and its appropriate IND and SOR that were applicable to the descriptor concerned as determined by the number of units described in the record that were conducting each aspect of naval warfare concerned.[128] Thus, the numbers of EEI, IND and SOR appropriate to an individual record would vary from record to record. This, in turn, would affect the length of the narrative group fields that could be used on given record. Total narrative length would then equal the number of characters remaining in the record after the last requirements field (REQ-FLD) applicable to the EEI. The REQ-FLDs, thus, are fixed fields that also recur a variable number of times. The narrative group fields are variable length fields. They vary from 0 - 132 characters.

CULPRIT provides the capability to accomodate these requirements both with regard to record design and to the output program. The method it employs consists of using a control field called the number of requirements field (NREQ-FLD) to indicate how many REQ-FLDs are in the record. Then the output program contains a compute statement that first multiplies the length of a given REQ-FLD by the value of the control field and subtracts the result from 492 to determine the length of the narrative (492-(6 x NREQ-FLD)) where 492 is the number of characters remaining in the event narrative record after NREQ-FLD. Other output programs

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[128] See pp. 102 and 218-220.

use a counter and a less than or equal to test operation against the value of NREQ-FLD to determine when the last REQ-FLD has been extracted from the record for output.

Sources of test data

Selection of a primary data set for NAVWARANALEX input posed some difficulties. Ideal input would have consisted of sample RAINFORM messages. Such messages that also provided a certain continuity on given, readily identifiable Soviet naval activites were not available at the Naval Postgraduate School where the project has been conducted to date. A variety of ocean surveillance products produced by OSIS that provided continuity on given Soviet naval activities were available at the Naval Postgraduate School. The one selected was the Fleet Ocean Surveillance Information Center Pacific's (FOSICPAC) naval intelligence summary that covered Soviet naval activities in the Indian Ocean on a daily basis. The period of coverage for each summary is 2300-2300Z.

Once this summary was selected, however, a different set of problems occurred. Although the summary, like other OSIS products, provides excellent coverage and cogent analysis of current Soviet naval activity; the format of these products complicates the input into a file organized in a manner such as those of NAVWARANALEX. Standard OSIS formats usually include a unit table giving the latest positions

and time of all platforms known to the OSIS node at publication of the product. The narrative portion of such summaries is divided into highlights, surface, submarine and air activities sections. Therefore, bits of information related to specific events and activities that could be identified in each summary are scattered throughout the unit table and the respective narrative sections.

Input to NAVWARANALEX required dissecting each summary to identify and correlate the individual bits of information to given events, NAVWARANALEX record types, and record fields. This is a rather tedious and time consuming process. If RAINFORM messages had been available, the process would have been easier because: (1) Individual RAINFORMs serve as inputs to the intelligence summary. Thus, the individual input would contain fewer bits to correlate than the summary as a whole. (2) NAVWARANALEX is designed to accept individual RAINFORMs directly into its records and record fields.

It should be pointed out that intelligence officers afloat who receive the OSIS product have to endure the same sort of dissection process to analyze that product if they desire to make unit associations and activity relationships. This is required to determine for the task group commander how the forces opposing him are organized and are operating. Naval forces do not operate independently as individual groups of specific surface unit types, submarine and aircraft.

They operate jointly as task forces involving specific senior, lateral and subordinate command relationships in order to coordinate the missions and activities of the participating units concerned.

While such relationships and activities are commented on and may be extracted from standard OSIS products, both the unit type format orientation and the scattering of the bits of information pertaining to unit relationships and activities do not serve to either order and differentiate the individual activities concerned or focus upon their individual ramifications. Automated output programs based on NAVWARANALEX files could provide intelligence summaries that would have such order and focus. Alternatively, NAVWARNALEX automated output programs could be formatted to give the intelligence summary whatever focus was deemed best for the OSIS product.

Query and Data Manipulation

This section covers five major topics relative to the development of the experimental files. These are quantitative analytical support, qualitative analytical support, information management support, and summary of network relationships and report programs.

It must be specified that not all the query capabilities discussed in this section have yet been programmed into the experimental system. Conceptually, they are

possible based on the file design. The report programs that have been developed to date are indicated in the next section in Table 33 on pages 298 - 300. Development of other programs required is dependent upon continuation of the project.

Quantitative analytical support

The discussion in this section pertains to the following subtopics: measuring activity parameters; and presymptoms, symptoms and patterns of activity.

Measuring activity parameters

Size.[129] The experimental files provide several ways for an analyst to obtain records applicable to the parameters of a particular activity of interest. First, he might specify the area of interest in terms of its geographic or grid coordinates. The corresponding record sort would be made on the basis of the positional elements of the track group field in the track record types. He would obtain records applicable to all events and activities in the area specified. Such a sort could also be made with current OSIS capabilities.[130] After the OSIS sort, however, the retrieved data would then have to be reviewed and manipulated manually to establish patterns of activity, unit associations and

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[129] See pp. [illegible] - 217.

[130] See pp. [illegible] - 251.

other relationships.

Under NAVWARANALEX, the basic area sort could be combined with other query specifications as discussed below to permit the system to assist in the determination of network relationships. For example, once the data has been retreived, the event numbers can be determined from the record identification group field. This determination provides a network link to all event narrative and unit records applicable to the specified events. If the analyst were interested only in particular events within the area concerned, he could have made such a specification as part of a chain query in the initial sort. If the analyst were interested only in unit records applicable to each track unit operating in the area concerned, the experimental system provides the capability to make such a link when the track numbers are known. The to track group field contained in all unit records provides this link.

Suppose the analyst desired to determine events and units that could be associated with a given place name rather than using a coordinate specification in his query. First, he would obtain the area number applicable to that place from the area reference records. Then he would query the port and area unit records using the given area number as the basis for his sort. Once these records had been obtained the values for their event number field and to track group fields would provide the link to other appropriate

records in the data base.

Suppose the analyst knew the events that were applicable to his area of interest and he wanted to determine the current parameters of that area. His initial query would specify obtaining the track records applicable to these event numbers. Then he would follow the steps described in the next paragraph.

Checking the position elements of the track records obtained in the final sort in the cases described above would provide the measure of the current size parameters of the activity concerned. This could be accomplished by a program that caused the system to list the position elements from the track records obtained in the final sort in coordinate order, either from east to west, or north to south, etc.

Period.[131] The primary chronological retrieval in OSIS in the past yielded all records applicable to the period specified. Then the analyst would have to manually review the retrieved data to determine the event relationships and unit associations involved in this activity just as he had to employ the same procedure for an area retrieval as discussed above.

Under NAVWARANALEX, the analyst would have the option of combining his period requirement in a chain query with

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[131] See p. 217.

other analytical interests relative to events, areas, types of units, individual units, aspects of naval warfare, descriptors of these aspects, or whatever other association he felt was within the capabilities of the file. While the primary chronological retrieval capability in NAVWARANALEX is based upon the event time element of the track group field, different times are cited in additional records as well. The ports and area unit records have an occurence date time group as one of their elements. The reaction records have an element that indicates the time of the closest point of approach during incidents at sea. The narrative records all have an event date as one of their elements. The requirement and area reference records all have a date of informaiton. Once the records that the analyst desired were retrieved, a measurement of the period of the activity could be made using a program that listed the time or date field pertinent to these records in chronological order.

Scope.[132] The number of aspects of naval warfare being practiced relative to a given event can be determined from the event narrative records. Recently developed NAVWARANALEX programs count not only each aspect reflected on a given event narrative record; but also within each aspect, count

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[132] See pp. 217 - 220.

the number applicable to each EEI and the number applicable to each IND or SOR under each EEI.[133]

Level.[134] The number of units participating in a given event is counted by a NAVWARANALEX program known as event unit composition. This report counts the number of different types of units (major combatant, minor combatant, submarine, AGI, research vessel, auxiliary, merchant, fishing vessel, aircraft, and friendly units). It then aggregates the total number for each day of the units participating in the event concerned.

Intensity.[135] The event unit composition report provides a measure of the number and types of unit components of the intensity variable. The number of aspects of naval warfare are measured by another program as described above. The capabilities of the individual units concerned can be obtained from the order of battle reference records. The capabilities they have been observed to demonstrate can be obtained from the ELINT, WEAPS, REACT, SIGSUM and RIG unit records, as well as the COMUSE, SENUSE, WEAPEM, TACEMP, RIGEQP, PERS and SUBORD event narrative records that pertain to the events concerned.

Presymptoms, symptoms, and patterns of activities

Once the variables of naval warfare have been observed

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133 See pp. 101 - 102.

134 See pp. 220 - 221.

135 See p. 221.

and measured as described above, the individual activity parameters corresponding to these variables can be established. Given a sufficient sample of individual activities, statistical techniques can be applied to these observations to assist determination of presymptoms, symptoms and patterns of activities. As Ackoff indicated, technology applicable to both statistical and quality control can be programmed into the information system. The remainder of this section discusses aspects of that technology and their application to features that have been designed into the experimental files.[136]

Descriptive statistics. The design features of the experimental files facilitate the application of descriptive statistics to the data they contain. Descriptive statistics has been defined as:

> "Any treatment of data which is designed to summarize or describe some of their important features without attempting to infer anything that goes beyond them."[137]

The statistical parameters that can be applied to the observations of naval activity that are reflected in various records are the standard ones that provide measures of both central location and central moment. With regard to central location, these include the mean, median and mode of

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[136] See pp. 43-45, 55-65, 93-95, 102, 111-114, 209-211, 217-221, 229-232.

[137] John E. Freund and Frank J. Williams, Elementary Business Statistics, The Modern Approach, 3d ed., (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1977) p. 1.

the data sampled in the particular set of records retrieved. With regard to moments about the mean or measures of variation, these would include range, variance, standard deviation and the coefficient of variation. Programs that have been developed in the project to date that sample and extract record data to measure these parameters are discussed below.

Essential to temporal activity analysis is a program to calculate the difference between dates. Such an algorithm has been developed in the current phase of NAVWARANALEX, although it has not been tested fully to date. Some of the principal applications of such an algorithm and the measurements it can provide include calculating the number of ship days in a given area (both for individual units and the total aggregate ship days) and the number of days a given unit has deployed out-of-area. In the past, analysts have had to retrieve the data that provided the basis for these determinations and then manipulated that data manually to reach a solution. The difference in dates algorithm and the proper program applied to the appropriate set of NAVWARANALEX records would give them an automated assist in reaching the solution.

Other periods of interest applicable to activity analysis include the time since last replenishment, the time since the last port call, time on station or patrol, underway time, time in port or at anchor, etc. Once

observations concerning the difference in times relative to any of these periods have been collected, programs from statistical packages could be applied to determine the statistical parameters relative to central location and central moment of the activity represented by the sampled records. Similar statistics could be compiled based on the fields and record sets that provided measurement of observations of the area variable.

The programs developed in the current NAVWARANALEX phase that provide measurement of both the scope of a given event on a given day (IND measurement) and the degree of collection coverage obtained against the unit participating in the event on that day (SOR measurement) have already been cited. Given the repeated collection of samples relative to each particular aspect of naval warfare, one could begin to construct frequency distributions of the Soviet practice of each individual aspects of naval warfare and the collection coverage obtained against such activities.[138]

The program developed to date that applies to observations of both the level and intensity variables also has been cited previously. This event unit composition program bases its count of the number of different type of units participating in a given event on a given day on two work

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[138] See pp. 273 - 274.

matrices that it constructs with the following column headings: Matrix A includes event number, event time, major combatant, minor combatant, submarine, AGI, research vessel, auxiliary, merchant, fishing vessel, aircraft, friendly unit, and total units. Matrix B column headings include event number, event time and track number. The program processes each of the five possible inputs in the individual track records that comprise the data sample. It then checks the event number, event date and track number field related to the given input to determine if that track unit already has been counted on the given day and the given event, or if that track unit input represents an addition to the total corresponding to its unit type. During this process it also determines when a new row should be added to the matrix. After completing the logical steps based on these determinations, the program continues processing each individual track input in the record until it has made the determination for all five track inputs or whatever amount of inputs less than five that the record contains.

A frequency distribution based on the results contained in Matrix A would reveal the pattern of unit types participating in a given event. A second program under development compares the results contained in these matrices to construct a third matrix. Matrix C includes the following column headings: track number, event date, and

the unit type and aggregate unit total described above. A frequency distribution based on this matrix would reveal the pattern of unit association of a given track unit over time.

Statistical inference. The exciting thing about the automated support of quantitative activities analysis that might be provided by programs such as those developed under the NAVWARANALEX project is not the potential of such programs for assisting the collection of descriptive statistics. More important are the implications of possible application of the methods of statistical inference. This branch of modern statistics is defined as:

> "A generalization that goes beyond the limits of the data."[139]

Once sufficient samples of the same or like activity have been collected and measurements of the statistical parameters related to each of the activity variables taken, then estimates with regard to each of the variables concerning the statistical parameters of the general population from which the samples were drawn could be constructed using various models from both probability and statistical theory. These parameters, once estimated and refined, could provide the standards against which deviations in current samples could be compared and tested for their statistical significance.

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[139]Freund and Williams, Elementary Statistics, p. 2.

It would require extensive investigation and testing to determine the applicability of inferential techniques to data that can be compiled by the experimental programs. Only after such a process has been completed, would it be feasible to determine which and how specific alert measures could be programmed into the system. This kind of effort remains to be pursued as it has been beyond these initial phases of the project. The ocean surveillance system, however, collects large volumes of data on a daily basis. Once programs were installed on OSIS to compile data in such a fashion, it would not take long before reasonable progress could be made toward constructing refined estimates of population parameters. Then it would be a matter of sufficient programming time to develop the appropriate detection and alarm features for the system.

A word of caution must be interjected. Care must always be taken in the application of statistical methods to social phenomena. What one would be attempting in this case is the testing of the substantive activities analytical theory through the use of tests that are constructed on the basis of methodological theory. The fact that one tests theory with theory has been one of the criticisms leveled at applications of hypothesis testing in the social sciences. Probability and statistical theory, like the development of the substantive theories these methods are used to test, is constructed using certain basic assumptions that must be taken as given and are beyond empirical

proof. That which is given is defined in the form of primitive terms. Definitions, axioms and theorems are deduced from these primitive terms by application of the rules of logic to form the foundation for either the substantive or methodological theory being developed. Thus, the criticism indicated above is usually leveled in the form of the question, how do you test theory with theory?

The way to proceed must start with recognition of the fact that probability models are mathematical abstractions or idealizations of the experiments they are constructed to represent. The basis for this construction lies in the primitive terms, definitions, axioms and theorems of probability. The events, which are the primary elements of probability theory, are directly parallel in meaning and function to the outcomes of experiments, which have been specified by the primitive terms, definitions, axioms and theorems of the particular substantive theory to which the methodology is being applied. If the application of the methodology is to yield significant results, one must ensure that the events to be observed and collected as specified by the substantive theory can be measured statistically.

Second, the parallel between the methodological event and the experimental event of function to outcomes must be maintained. It if is not, the methodology may yield results that appear statistically significant based

on the relevance they indicate with regard to relationships in the number system; but they may not have any relevance to the relationships predicted by the substantive analytical theory. Ways to ensure that this event parallel is maintained and that the experimental event can be measured using a probability model include specifying the experimental events so that they are both mutually exclusive and exhaustive with regard to the logical possible outcomes of the experiment. If one is successful in this specification process, the basic laws of probability should apply to the experimental outcomes. Each event should satisfy the axiom that its probability lies between 0 and 1. The aggregate of all event probabilities should equal 1.

After the events to be collected have been specified for the experiment, the next step represents the most critical one in the entire process. It consists of assigning values as probabilities to the events in the model. The most prevalent ways of assigning probability as a value are: (1) Stating the likelihood of the outcomes occurring in the real world based on conditions of logic, symmetry and identity. (2) Observing the value of the frequency of individual outcomes as the experiment is repeated an unlimited number of times. (3) Assigning a weight to an event that indicates the strength of expert opinion of the expectation that the event will occur at some time in the

future.

After the measurements based upon the assigned probabilities have been taken, both these and the experimental outcomes must be assessed to determine if they remain consistent with those predicted by the methodological and substantive theories respectively. If the measurements prove inconsistent, then the methodological theory must be revised or expanded to allow for the measures observed in the particular case. If the experimental outcomes are judged to be inconsistent with the predicted ones, then the primitive elements of the substantive theory may have to be revised or expanded to allow for these observations. Alternatively, the deductions made in the development of the substantive theory may have to be re-examined and revised. Thus, a recycling of the steps in the process occurs. Then one proceeds once again with the measurement operations. This recycling of the steps in the process continues until all contradictions in the theories concerned have been eliminated. The substantive theory developed in such a manner to include the use of the methodological theory to test and validate it will then provide a coherent framework for the quantitative analysis of naval activities.

Statistical packages. The techniques and procedures of relevant methodological theory that may be applied to

the quantitative analysis of naval activities are found in such powerful, commercially produced statistical packages as the Statistical Package for the Social Sciences (SPSS) and the Biomedical Computer Programs (BMDP). Both these packages contain a variety of procedures that are useful applications of both descriptive and inferential statistics. Examples of the relevance of some of these procedures to naval activity analysis are discussed below.[140]

With regard to procedures relevant to applications of descriptive statistics, frequency procedures can be used to produce histograms and univariate plots. If generation of only the statistical estimates of population parameters is the objective, the condescriptive procedure in SPSS and program one in BMDP will handle this task. Other programs contained in these packages allow the grouping of data to gain better analytical focus and highlight specific relationships, transformation of data in order to standarize it or for sanitization purposes, the exclusion of both missing and extreme values contained in the data in order to prevent them from distorting the analysis.

With regard to statistical inference, both packages contain procedures that permit bivariate analysis to

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[140] See Norman H. Nie et.al., Statistical Package for the Social Sciences (SPSS), 2d, ed., (New York: McGraw-Hill Book Company, 1975) and W.S. Dixon and M.B. Brown, eds., Biomedical Computer Programs P. Series (BMDP-79), (Berkeley, California: University of California Press, 1979).

include scattergrams to produce two way plots and cross tabulation to deal with conditional events. These and other procedures can be extended to perform multivariate analysis in order to explore the relationships between the variables being examined. Multiway frequency tables can test whether row variables are independent of the column variables in a matrix. Regression programs can print and plot residuals and predicted values, identify best subsets of independent variables, identify a good set of predictor variables, and establish the degree and strength of the correlation between multiple independent variables. Programs performing the analysis of variance and covarience are also available in these packages. These procedures permit the test of the difference between means of two or more groups or subpopulations. Cluster analysis procedures may be employed early on in exploratory or data analysis when it is suspected that the data may not be homogeneous and it is desired to reduce the data into groups. Factor analysis procedures can be used if correlations of large numbers of variables are required. Essentially this technique clusters the variables into factors such that the variables within each factor are highly correlated. Then it interprets each factor according to the variables belonging to it and is able to summarize many variables by employing a few factors. The individual factor loadings should either be very large or very small so each variable is associated

with a minimum number of factors. Canonical correlation analysis procedures extend regression analysis to determine a linear combination of the X variables that have maximum correlation with a linear combination of the Y variables.

Summary of project's quantitative efforts

Progress made in NAVWARANALEX to date with regard to the development of quantitative analytical support capabilities is summarized as follows: Substantive analytical theory has been conceived and formulated to permit the specification of naval activities and events that can be observed and collected. It has identified activity variables and established means for measuring their parameters with regard to the events that have been sampled in the collection process. It has suggested how inferential statistical techniques might be applied to developing estimates of the population parameters related to the activity variables once a sufficient number of like or similar events have been sampled by the ocean surveillance system for processing by NAVWARANALEX capabilities after they have been installed on OSIS. The desireable properties of the population estimators developed through this process should be those that are unbiased, efficient, consistent, sufficient and robust. An additional criteria for

the development of these estimators is that it should minimize the mean square error.

Once population parameters have been estimated and refined, the estimates of these parameters could be used as standards against which deviations in current samples of naval activity obtained through the ocean surveillance system could be compared and tested for their statistical significance. It was emphasized that it would require extensive investigation and testing before this process of applying inferential statistical techniques and procedures to naval warfare data could be completed. Caution as to the care to be taken when applying statistical methods to social phenomena such as naval activities was also interjected. Methods of constructing probability models to perform the empirical experiments on the naval warfare data samples were then discussed. Assignment of values or probabilities [illegible] would initially have to be done using either the method of weighting expected outcomes on the basis of expert opinion or stating the likelihood of outcomes based on logic, symmetry and identity. As more and more naval warfare data samples were gathered and accumulated in the data base, the estimates of population paramenters could then be refined by basing them on the frequency of observed outcomes. The section then went on to describe the cyclical process required to develop fully a coherent analytical theory.

Finally, techniques and procedures readily available in commercial automated statistical packages and their applications were briefly described.

Qualitative analytical support

This section covers two subtopics, means of access and analyst/system interaction.

Means of access

The means of access to naval warfare analytical data currently available to OSIS and described previously included the platform status, mission and characteristics files; the ocean surveillance product file; area retrievals; and chronological retrievals.[141] Both platform status and mission history files may be accessed by individual unit, unit type, and trademark identifiers. The first file also provides both operational and material readiness status data. The [illegible] is found primarily in the order of battle files and the track records under NAVWAR-ANALEX as described previously. Here the similarities end, however.

Under OSIS, the individual track data may be sorted and differentiated from one another. If the analyst were interested in the unit associations acquired by a given track unit over time, however, he has been limited in the

[141] See pp. 248 - 251 and 269.

past by the degree to which the system was able to make such machine assisted associations. Under NAVWARANALEX, once the records applicable to an individual track have been identified, network linkage provided by the event number element of the record identification fields of these records permits retrieval of all other event narrative and unit record data associated with these track records.

The to track group field network linkage also can be employed if the analyst is only interested in other unit record data that is associated with the track records obtained in the initial retrieval. In fact, the to track group field not only links other unit record data to a given track unit, but also the sort based on this field will link the other unit data to given positions and times in the given track unit's chronological plot.

Other unit record network relationships are provided by the order of battle cross-reference group field (OOB XREF) in the track records and the area reference number element (AREA REF-NO) in the port and area group field of those unit records. These fields link given track records to the proper order of battle reference records and given port and area records to the proper area reference record subset. Thus, if the analyst is interested in obtaining historical documentation concerning particular units or particular areas, he may do so by employing these networks links.

Supposing the analyst wished to study records

applicable to aspects of naval warfare. The records in the NAVWARANALEX files could be sorted according to each individual EEI. This sort process would have to extract each record on the basis of the first REQ-FLD encountered and then return again and again to select the record for listing under the other REQ-FLDs it contains. The sort process would end after all REQ-FLDs in every record of interest had been selected. Another option would be to simply list all event narrative records in record type order. Another option would be to list all event narrative and unit records of interest in record heirarchy order. If the analyst wished to consider historical data from the reference records, he could list that set in NARR-ID order since this element corresponds to the various descriptors of the aspects of naval warfare. In any of the cases above, his query statement could specify parameters applicable to a single descriptor of the aspects of naval warfare. Further, his analytical interest of the moment could be specified using a chain query. The structuring of such chain queries theoretically would be limited only by his imagination and the number of fields in NAVWARANALEX records.

Analyst/system interaction

In summary, the NAVWARANALEX system provides increased automated assists to the qualitative analysis of naval

activities over what has been available to OSIS in the past as follows: It provides increased opportunities for the analyst to formulate chain query specification tailored to his current problem. It provides the capability to both expand initial queries to obtain associated data by employing network linkages and to narrow query specifications to focus on particular issues. The network linkages designed for the files preserve previous analytical relationships and associations and preclude these from having to be recreated through manual review and manipulation of data by analysts working on a current problem. If later evidence available to the analyst studying the current problem contradicts the preserved relationships and associations, they can either be deleted from the file or the additional evidence and analytical comment can be inserted into the file in records tied to these previous records by the sequential record number element and the value of the event number element in the record identification group [illegible] applicable to the record type and event number concerned. NAVWARANALEX also permits acceptance of data from the formatted message system beyond that which has been extracted by OSIS in the past, which primarily included only track plots, event times, and some narrative data. Thus, the experimental system preserves a greater level of detail than has been the case in the past with regard to OSIS files. The hierarchical set and network relationship capabilities

allow both the development of a variety of analytical products and the ability to provide linkages to bits of information contained in all records pertaining to the same event. This has not been the case with most ocean surveillance product files, which could be accessed only by the date time group of each individual message contained in the file.[142] Finally, the system alerts provided by NAVWARANALEX quantitative analytical support capabilities can assist analyst focus on the qualitative aspects of the activities and events concerned.

Information management support

The current features designed into the file to provide information in support of management activities may be divided into two categories: those that support collection management effort, and those that support production management activities.

Collection management

As cited earlier, a report program similar to the one that compiles measurements of the scope of naval activity compiles measurements of the degree of collection coverage reflected in the OSIS data base for a given day or over time.[143] In addition to assessing the degree of collection coverage given each SOR under each EEI, managers

[142] See pp. 251 and 267 - 269.

[143] See pp. 273 - 274.

might want to analyze that coverage by area, unit type, track unit, etc. Programs could be written based on chain queries to provide the output desired.

The target of the activity descriptor in the event narrative record set has been established in NAVWARANALEX not only to insert narrative and analytical comment concerning the activities of the recipient of the interaction, but also by convention to report collection results. The collection report narrative should record not only the collection unit's participation in the interaction, but also cite the sensor results that it has obtained and indicate where they were forwarded for processing. Thus, a target activity report could provide a qualitiative sense of the collection effort. The unit record within the target activity hierarchical set is the sensor event record. It contains data related to the various sensors employed by the collecting unit.[144]

Other unit records that contain collection results of particular interest include: The HFDF records document the results of the high frequency direction finding network. The ELINT records document the electronic intelligence acquired. The weapons records indicate the specific weapons employed by particular participating units. The SIGSUM records document the acoustical intelligence acquired. Finally, the rig records record the profile of

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[144]See Table 31 on pp. 259 - 260, and the discussion in Chapter IV on pp. 228 - 229.

merchantmen encountered.

Production management

The principal assistance that NAVWARANALEX provides production management activities relates directly to the variety of ways in which the data base may be accessed. The increased means of access provide the capability to locate and identify rapidly available data that is applicable to particular products in the production schedule. Report programs can be written to output data in the particular format desired. Beyond the production schedule, these capabilities can also assist the development of special products tailored to the specific current interst of the particular consumer concerned.

Summary of Network Relationships and Report Programs

Throughout the discussion in this chapter particular hierarchical set and network relationships have often been cited as being designed into the experimental files. Table 31 on pages 259 and 260 outlined the particular hierarchical set relationships involved. Table 32 summarizes the network relationships that have been discussed. Report programs have also been cited throughout the chapter as being developed, under development, or requiring development. The report programs mentioned and suggested are summarized in Table 33.

TABLE 3[illegible]

NETWORK RELATIONSHIPS

RECORD SET	FROM	TO	PURPOSE	PAGES
Reference	REF-NO element of RECORD-ID group field.	All other records with the same REF-NO.	Links all records containing data applicable to the same reference record type.	261-264
	NARR-ID element of RECORD-ID group field.	ACT-TYPE element in RECORD-ID group of corresponding event narrative record.	Permits retrieval of reference record set in the same hierarchical set order as the event narrative record set. Also permits retrieval of the reference record data applicable to a particular descriptor of the aspects of naval warfare.	261-264, 289-290
Event Narrative	REQ-FLD variable recurring fields.	The aspects of naval warfare and the REF-REQ-NO field in the requirements reference records.	Permits both counting of the IND and SOP under each EEI that represent each aspect of naval warfare and retrieval of qualitative data applicable to particular aspects of naval warfare.	265-267, 289-290, 292-29[illegible]
Event Narrative and Unit	EVT-NO element of RECORD-ID group field.	All other records with same EVT-NO.	Links all records containing data applicable to the same event.	261-264, 267-269, 288-289, 291
Unit	TO-TRACK group field in track records	TO-TRACK group field in all other unit records.	Links all unit records containing data applicable to a given event time in the plot of a given track unit.	258, 289

TABLE 32

(Continued)

RECORD SET	FROM	TO	PURPOSE	PAGES
	EVENT-TIME field in the track records.	OCC-DTG in ports/area, CPA-DTG in reaction, EVENT-DATE-GP in event narrative, area and order of battle reference records.	Links all data applicable to the same date of information.	272-273
	GEO-POSIT field in the track records.	LAT-ORIG-CTR and LONG-ORIG-CTR in bearing/ellipse, OCC-POSIT in ports/area, and LAT-LONG in area reference records.	Links all data applicable to the same position or area.	270-272
Unit	UNIT-COMP field in track records	Associated units and event unit composition.	Links given platforms and events with associated and paritipating unit types.	274
	OOB-XREF group field in track records.	REF-NO element in RECORD-ID group of order of battle reference records.	Links given platform with unit identifiers and historical data contained in order of battle reference records.	289
	FM-TRK-LN-RCD-NO in bearing/ellipse records.	TO-TRACK group field in track records.	Links platform that is located at the origin of a bearing to the platform that is at the terminus of a bearing.	259

TABLE 32

(Continued)

RECORD SET	FROM	TO	PURPOSE	PAGES
Unit	AREA-REF-NO field in ports/area record.	REF-NO element of RECORD-ID group, area reference records.	Links ports/area records to historical data and place name contained in the area reference records.	270-272, 284
Unit	INC-TRK-NO field in reaction records.	TRACK-NO field in the track records.	Links the target of an incident at sea to its track identifier.	260, 273
All	RCD-TYPE element of the RECORD-ID group	All other records with the same RCD-TYPE.	Links all records containing data applicable to the same record type.	261-264, 291
All	RCD-HIER-NO element of the RECORD-ID group.	All other records with the same RCD-HIER-NO.	Permits selection of a record applicable to a given record type. Allows reporting of records in RCD-HIER-NO order.	261-264, 291
All	RCD-NO element of the RECORD-ID group.	All other event narrative, unit and reference records having the same RCD-TYPE and EVT-NO or REF-NO.	Links all records containing data applicable to the same record type and event or reference number.	261-264, 291

TABLE 33

REPORT PROGRAMS

PROGRAM	PURPOSE	STATUS	PAGES
Reference Report - Aspects of Naval Warfare	Documentation of the reporting requirements on foreign naval operations in EEI format.	Under development.	265-267
Reference Report - Area History	Gives place name, geographical and grid coordinates of areas of naval interest. Provides historical data concerning activities in that area. Narrative ordered according to the descriptors of the aspects of naval warfare.	Under development.	270-272 [illegible]
Reference Report - Order of Battle	Provides unit identifiers, operational and material readiness status, and historical data concerning the activities of surface and submarine platforms, and aircraft types. Narrative ordered according to the descriptors of aspects of naval warfare. Report ordered according to unit type.	Under development.	[illegible]8[illegible]
Reference Report - Record Documentation	Provides documentation of the content and structure of the fields applicable to various record types.	Under development.	257-258

TABLE [illegible]

(Continued)

PROGRAM	PURPOSE	STATUS	PAGES
Activity Report - [illegible]	[illegible] values of the fields [illegible] record types.	Under development.	[illegible]
Activity Report - Event Narrative	Outputs [illegible] record set in event number order and within event number by event date and within event date by the descriptors in record hierarchy order.	Developed. No. [illegible]	[illegible]
Activity Report - Activity Listing	Outputs event narrative and unit record set in event number order and within event number by event date and within event date in record hierarchy order.	Under development. No. 30	267-269
Activity Report - Scope of Activity	Measures the scope activity variable by counting [illegible] under each EEI.	Developed. No. 32.	265-267, [illegible]-274, 277, [illegible]
Activity Report - Degree of Collection Coverage	Counts SOR under each EEI.	Developed. No. 33.	265-267, 277, 289-290 292-29[illegible]
Activity Report - Difference in Dates.	Provides results of difference in dates algorithm.	Developed. No. 34	276-277
Activity Report - Event Chronology	Provides event numbers and tracks applicable to specified period.	Projected	272-273

TABLE 33

(Continued)

PROGRAM	PURPOSE	STATUS	PAGES
Activity Report - Area Search	Provides event numbers and track in specified area.	Projected	278-272, 289
Order of Battle Report Track	Outputs unit identifier from order of battle reference records and plots from track records for each track unit.	Developed. No. 02.	258, 288-289
Order of Battle Report - Unit Association	Provides the unit types associated with a given track unit during its deployment.	Under development. No. 03.	267-269, 274, 277-279, 289
Order of Battle Report - Event Unit Composition	Measures level and intensity activity variables by counting the number of unit types and total units interacting in a given event on a given day.	Developed. No. 04.	274, 277-279, 289
Order of Battle Report - Platform Data	Outputs all data from unit record set applicable to a given track unit. Report order by track number, within track number by event time, within event time by to track number and record hierarchy number.	Projected	258
Order of Battle Report - Track Number	Provides event numbers in which given track participated over time.	Projected.	258, 288-289

Comparison of NAVWARANALEX to the Reality Situation

It may appear that perhaps the design of the naval warfare experimental information system is too extensive. What has been presented is a consideration of what could and should be done with regard to improvements to OSIS. In this regard, consideration of the cost of these developments has yet to be examined and assessed. Such consideration may temper the projected development in a particular direction. Overall, however, it does appear that NAVWARANALEX offers incremental improvements over past OSIS capabilities in the areas of quantitative activities analysis, qualitative activities analysis, and information management support.

Why should progress be made toward implementation of as many of the features described as possible? The author believes that it is sufficient to recall Admiral Gorshkov's objectives and intentions to answer this question.

> "Establishing conditions for gaining sea control has always required lengthy periods of time and the execution of a series of measures while still at peace. These measures include the development and preparation of the necessary forces and material and maintaining them in readiness to accomplish combat missions, concentration of groups of forces and disposing them in a theater in such a manner that they will have superiority of position over the enemy, and also providing of facilities in the sea and oceanic theaters of military operations, the proper organization of forces and a base system appropriate to their mission, a system for controlling them, and so forth."[145]

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[145] Gorshkov, Seapower, p. 297 as quoted in Chapter III, p. 148.

VI. THE SOLUTION: CONCEPT OF OPERATIONS AND IMPLEMENTATION

The Naval Warfare Analysis Experiment in Perspective

This perspective summarizes the results and conclusions obtained through NAVWARANALEX to date and outlines additional efforts that can be conducted in the future. The conclusions outlined below were documented in Chapter I based on research in the fields of threat perception, crisis management, systems analysis and management information systems.

A. The information system that best serves management is one that:

(1) Generates indicators and performance data which permit detection of problems and opportunities at the symptom and presymptom stage.

(2) Provides the capability to compare actual performance and outcomes with those projected in the plan.

(3) Employs data base organization constructed on the basis of developed information theory which specifies the context of problems anticipated, provides a framework for their analysis, and models the functioning of all management system components.

(4) Includes query and sort capabilities which both allow focusing on the parameters directly attributable to the current problem

and permit expanded search and retrieval to capture additional information relevant to new parameters as they are perceived and come into play.

B. Such an information system, thus, serves as management's institutional consciousness and memory to increase the sensitivity with which the management system is able to perceive problems and opportunities. It further serves to increase the sensibility with which management responds to the reaction that has transformed the controlled system's internal state as a result of stimuli generated by both system and environmental activities.

C. If the problem is an international crisis, management efforts are complicated by the fact that the nations involved in the crisis must not only monitor:

(1) The performance and activities of the politico-military system that each nation controls and

(2) Activities in the international politico-military environment, but also

(3) The performance and activities of opposing national politico-military systems which they can only influence, but not control.

D. Sherwin demonstrated that:

(1) These management information system concepts can be applied to the design and construction of a computerized information system for crisis management.

(2) Techniques for transforming information about such elusive social phenomena as crisis symptoms into machine readable data and empirical indicators are feasible.

(3) Such an information system can support both quantitative and qualitative activities analysis.

(4) An Executive Decision Aid to perform the insititutional consciousness and memory function by scanning historical precedents to reveal

options taken, problems encountered, and successes realized in previous crises can be developed and implemented.

Results of the systems analysis of the intelligence system conducted in Chapter II are indicated below.

A. The systems of concern to the intelligence system are the system of international naval force interaction located within the system of international politico-military activities and the management system located within the U.S. naval system.

B. The legitimate goals of the naval management system include the development of the doctrine, strategy, tactics, force levels, readiness posture, platforms, sensors, weapons, countermeasures, and other capabilities required to meet potential naval threats to the nation's security and interests.

C. The intelligence system functions to produce a product as a service to other components of both the naval management system and the naval system.

(1) This process is cyclical in nature and has the interjection of the intelligence product into the command planning and decision making process during the consumption segment of the cycle as its primary goal.

(2) The purpose of the product is to provide capabilities and activities analysis of the naval systems of the world which might oppose and threaten U.S. national security and interests.

(3) The key to the smooth, effective functioning of the cycle is management's performance of the control function. Control of the intelligence system should ensure that the activities performed by participants are based on an accumulation of knowledge concerning and continual awareness of the requirements of the system institutionalized and established in the tasking phase of the cycle.

(4) The requirements that guide the functioning of operational intelligence components of the system as they perform activities analysis are the national requirements for reporting on foreign naval operations issued in varying forms throughout the chain of command.

D. The intelligence officer must be an efficient and effective consumer of science. While he is called upon to perform many roles within the intelligence system the two primary ones that he must perfect for career development purposes are those of first analyst and then manager.

E. The systems view of problem solving offers an analytical orientation and methodological tools that can assist management efforts to plan, develop, direct and control intelligence programs and activities. This conceptual model includes consideration of the reality situation, the conceptual model, the scientific model and the solution, as well as the interaction that should take place between these steps in the problem solving process.

The assessment of the reality situation documented in Chapter III indicates the potential threat that the expansion of the Soviet naval system poses to U.S. national security and interests. Principal conclusions include:

A. Admiral Gorshkov already has achieved many of his objectives toward building a balanced navy and maritime power of the first rank.

B. The expansion in naval capability will continue through the year 2000 primarily in qualitative terms of more sophisticated platforms and systems and more offensive firepower.

C. The expansion in naval development has reached the point where the Chief of Naval Operations has testified before Congress that one cannot state with confidence that the U.S. Navy has a margin of superiority over its Soviet counterpart.

D. The documentary evidence indicates that the Soviet leadership has the will to employ aggressively the naval capabilities that Admiral Gorshkov has developed to support their national security and foreign policy. This employment includes extensive activity on a world wide basis by all the components of Soviet seapower.

The analytical and information management theory developed as the conceptual model in Chapter IV formulates the specifications below:

A. The operational intelligence process should focus on key questions suggested by the requirements of the operational components of the naval system for the intelligence product.

B. The reporting requirements on foreign naval operations in EEI format lend an analytical framework that provides such a focus because they:

(1) Identify and establish variables that can be observed, measured and manipulated quantitatively to provide indications of presymptoms, symptoms and patterns of activity.

(2) Identify and establish descriptors of the aspects of naval warfare that can organize naval warfare narrative data in a manner that leads to the qualitative capture and refinement of the essence of naval warfare activities.

C. The design of information system capabilities to improve OSIS should increase the level of detail of data preserved in the system and the means of access to that data; provide the capability for both focused and expanded queries; increase analyst/system interaction; and preserve analytical associations made between activities, events, participating and target units.

Progress concerning the development of the scientific models to guide the implementation of OSIS improvements is outlined in Chapter V. Specific results and projected

development are indicated below:

A. Hierarchical set organization of records and the establishment of network relationships between particular record fields support the variety of access and interactive query capabilities desired. Such support is further enhanced by the employment of the indexed sequential processing method.

B. Programs have been developed to observe and measure both activity variables and the aspects of naval warfare quantitatively.

C. Development of OSIS should include the incorporation of powerful statistical packages that are available commercially today.

D. Qualitative activities analysis is enhanced under NAVWARANALEX by providing increased means for connecting current event related data with historical activities documentation; combining collection report narratives with analytical commentary; and preserving the level of detail to facilitate the development of long term activity studies in addition to the support of current operational intelligence analysis.

E. Specific features to support both collection and production management efforts have been incorporated into the file design. Capabilities to support information management activities should be a prime consideration in any future OSIS development.

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